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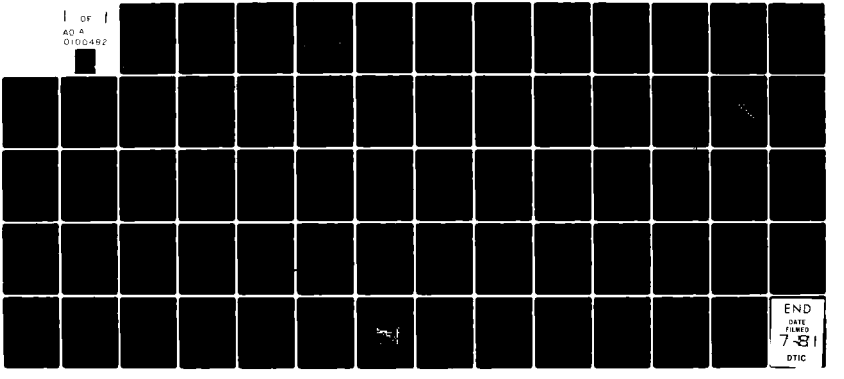

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ASSESSMENT OF THE COMBAT DEVELOPER'S ROLE IN POST-DEPLOYMENT SOFTWARE SUPPORT (PDSS) 30 JUNE 1980 - 28 FEBRUARY 1981

EXECUTIVE SUMMARY AND FINAL REPORT

Volume I

UNITED STATES ARMY
COMBINED ARMS COMBAT DEVELOPMENT ACTIVITY
FORT LEAVENWORTH, KANSAS 66027

BDM SERVICES COMPANY
LEAVENWORTH, KANSAS 66048

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20. ABSTRACT (CONTINUED)

The Phase I effort was conducted to identify and describe the current macro-management level and battlefield functional area (BFA) level PDSS structure and processes, relate these processes to other Combat Developer functions, and identify the Combat Developer's PDSS requirements, regulatory and directive authority, and the BAS that must be supported. Phase I results were documented in the First Interim Technical Report, Volume II, 30 September 1980.

The Phase II effort was directed toward defining three TRADOC functional and management PDSS systems. The first of these systems, the Baseline System, was developed from information gathered and analyzed during Phase I. The description of this system identifies currently-authorized resources, and also projects resource requirements needed to accomplish future PDSS using the present macro- and BFA-level structure. Next, a Theoretical System, unconstrained by resources, was described which would accommodate all identified Combat Developer PDSS-related functions. Finally, a Hybrid System was described recognizing the realities of current organizational structures and their functional responsibilities. These three systems were designed to provide a basis for TRADOC to either select or derive a preferred alternative. Phase II results were documented in the Second Interim Technical Report, Volume III, 16 December 1980.

Phase III of this study provided an Implementation Plan for transitioning from the present situation to the Objective (preferred) System derived by TRADOC from the alternatives presented in Phase II. Also included was a description of the proposed Objective System. Phase III results were documented in the Third Interim Technical Report, Volume IV, 31 January 1981.

This Executive Summary and Final Report, Volume I, 28 February 1981, provides an overview of the entire study as described in the First, Second and Third Interim Reports. This report includes assumptions and methodology used, as well as conclusions and recommendations reached.

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UNITED STATES ARMY
COMBINED ARMS COMBAT DEVELOPMENT ACTIVITY

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ASSESSMENT OF THE COMBAT DEVELOPER'S ROLE IN POST-DEPLOYMENT SOFTWARE SUPPORT (PDSS) 30 JUNE 1980 - 28 FEBRUARY 1981

Executive Summary and Final Report

Volume I

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NOTICES

CONTRACT REQUIREMENT

This document contains the Executive Summary and Final Report of the Assessment of the Combat Developer's Role in Post-Deployment Software Support (PDSS) under Contract Number MDA903-80-C-0479 and satisfies Contract Data Requirements List (CDRL) Item Number 0002AF.

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ACKNOWLEDGMENT

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ABSTRACT

This study addressed the role of the US Army Training and Doctrine Command, as the Army's principal Combat Developer, in planning for and providing post-deployment software support (PDSS) to battlefield automated systems (BAS). The Study was a three-phase effort directed toward defining a viable, feasible, and cost effective functional and management structure for the Combat Developer to provide PDSS for BAS, within the framework of Army doctrine and policy, the Post-Deployment Software Support Concept Plan for Battlefield Automated Systems, and the related functional requirements of the Combat Developer.

The Phase I effort was conducted to identify and describe the current macro-management level and battlefield functional area (BFA) level PDSS structure and processes, relate these processes to other Combat Developer functions, and identify the Combat Developer's PDSS requirements, regulatory and directive authority, and the BAS that must be supported. Phase I results were documented in the First Interim Technical Report, Volume II, 30 September 1980.

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GLOSSARY

ACSAC--Assistant Chief of Staff for Automation and Communications

BAS--Battlefield Automated Systems

BFA--Battlefield Functional Area

CACDA--Combined Arms Combat Development Activity

CBE--Command Budget Estimate

CCB--Configuration Control Board

CCS2--Command, Control, and Subordinate Systems

CD--Combat Developer

CD PDSS LNO--Combat Developer Post-Deployment Software Support Liaison Office

CDSF--Combat Development Support Facility

CDSM--Combat Development System Manager

CORADCOM--Communications Research and Development Command

CRMP--Computer Resources Management Plan

CRWG--Computer Resources Working Group

CSC--Computer Systems Command

CSS--Combat Service Support

CT--Contact Team

DARCOM--US Army Materiel Development and Readiness Command

DCSCD--Deputy Chief of Staff for Combat Developments, TRADOC

DCSRDA--Deputy Chief of Staff for Research, Development, and Acquisition

FSCB--Fielded Software Control Board

FSSC--Fielded Software Support Center

GS/DS--General Support/Direct Support

HQDA--Headquarters, Department of the Army

ICM--Interoperability Configuration Manager

INSCOM--US Army Intelligence and Security Command

MD--Materiel Developer

OTEA--US Army Operational Test and Evaluation Agency

PDSS--Post-Deployment Software Support

RDA--Research, Development, and Acquisition

S2M2--Software Support Materiel Manager

SAG--Study Advisory Group

SSC--Support Software Center

SSCB--Support Software Control Board

TC4S--Telecommunications, Command and Control, and Computer Systems

TRADOC--US Army Training and Doctrine Command

TSM--TRADOC System Manager

USACC--US Army Communications Command

USACSC--US Army Computer Systems Command

EXECUTIVE SUMMARY

1. INTRODUCTION.

a. General. The US Army has spent, is spending, and will spend many billions of dollars on sophisticated battlefield systems to improve the capabilities and effectiveness of our ground forces. The automated components of many of these systems have increased rapidly in just a few years to the point where automation represents a very substantial, and in some cases the major, portion of system costs. The military value of such systems, in terms of combat effectiveness and combat readiness, cannot be realized unless individual systems perform as intended by the user and the many interdependent systems interoperate as an integrated whole. Achievement of such objectives is a problem of system planning, integration, management, and support--throughout the system life cycle. Because of the increasing role of automation and greater interdependence among battlefield automated systems, resolution of this problem calls for new approaches and orientations in the system development and life cycle management process. Organization, resources, and procedures are all impacted. The US Army Training and Doctrine Command (TRADOC) is taking steps to address this problem and identify and implement necessary changes, in concert with other Combat, Materiel, and System Developers. This TRADOC study addresses a critical part of this total problem--that part dealing with post-deployment software support (PDSS).

b. The PDSS Requirement. The requirement to provide PDSS to the growing number of battlefield automated systems (BAS) projected to enter the Army inventory during the next several years is one of increasing concern within the Army. The Users, Materiel Developer (MD), and Combat Developer (CD) all have essential roles in the total effort to provide effective PDSS for BAS. TRADOC, as the Army's principal CD and the "battlefield architect", is responsible for determining what capability is required and when it is required. The magnitude and complexity of fulfilling this responsibility, especially with respect to automated systems, necessitates that the CD interact closely with both the User and MD to ensure that MD capabilities are fully employed and User requirements are satisfied to the maximum extent possible. This CD responsibility applies to initial system development and to any subsequent post-deployment changes to a system. In carrying out this role, the CD must be a driver, innovator, and active representative of all Field Users.

2. PURPOSE.

The purpose of this three-phase study was to define, in detail, a viable, feasible, and cost effective functional and management structure through which the CD can fulfill his role in providing PDSS for BAS within the framework of Army doctrine and policy, the Army PDSS Concept Plan for BAS and the related functional requirements of the CD.

3. DISCUSSION.

a. Background.

(1) Requirement for an Army-Wide PDSS System. Recognizing the increasing importance of PDSS, the US Army Materiel Development and Readiness Command (DARCOM) initiated a study in July 1978, in accordance with guidance from the US Army Vice Chief of Staff, directed toward developing a concept for a systematic approach to planning for and providing PDSS for BAS on an Army-wide basis. Within DARCOM, the Communications Research and Development Command (CORADCOM) was tasked with primary responsibility for that study. A task force of representatives from the Army Staff and several Army commands was formed to assist CORADCOM in this effort. Results of the effort are documented in a report entitled PDSS Concept Plan for BAS, May 1980. Both DARCOM and TRADOC have concurred in that report which has been forwarded to Headquarters, Department of the Army (HQDA) for approval.

(2) Approach selected to satisfy the requirement. The task force that conducted the DARCOM-initiated study considered several alternative approaches for providing PDSS to the large number of BAS projected for deployment over the next several years. The approach selected and documented in the PDSS Concept Plan cited above, focuses on the battlefield functional area (BFA) concept since it is within each BFA that the doctrinal, functional, and technical dependencies and interoperability needs are the greatest. Figure 1 illustrates the major elements currently considered to be included in the BFA concept. In consonance with this concept, an approach called the "Hybrid Approach" was selected. This approach calls for MD-managed PDSS centers to be located at five TRADOC doctrinal centers/schools and six materiel development commands. This approach recognizes both the doctrinal sensitivity of certain BAS and the inherently technical complexity of others. This approach requires a case-by-case review of systems and a separate decision as to the optimal location(s) for fielded software support for each. This approach is designed to achieve the software support benefits resulting from BFA orientation while recognizing the realities of current organizational structures of DARCOM and TRADOC, and the functional responsibilities of the US Army Intelligence and Security Command (INSCOM), the US Army Communications Command (USACC), and the US Army Computer Systems Command (USACSC).

(3) Concept for Materiel Developer and Combat Developer facilities. The hybrid approach, discussed above, recognizes the need for both MD and CD facilities for PDSS. The number and location of MD facilities are addressed specifically in the PDSS Concept Plan for BAS; however, CD facilities are only addressed conceptually.

(a) Materiel Developer facilities. With respect to MD facilities, the plan recommends the establishment/maintenance of 11 PDSS software support centers as shown in Figure 2. As indicated in the figure, four of these centers are currently operational, although some expansion may be desirable

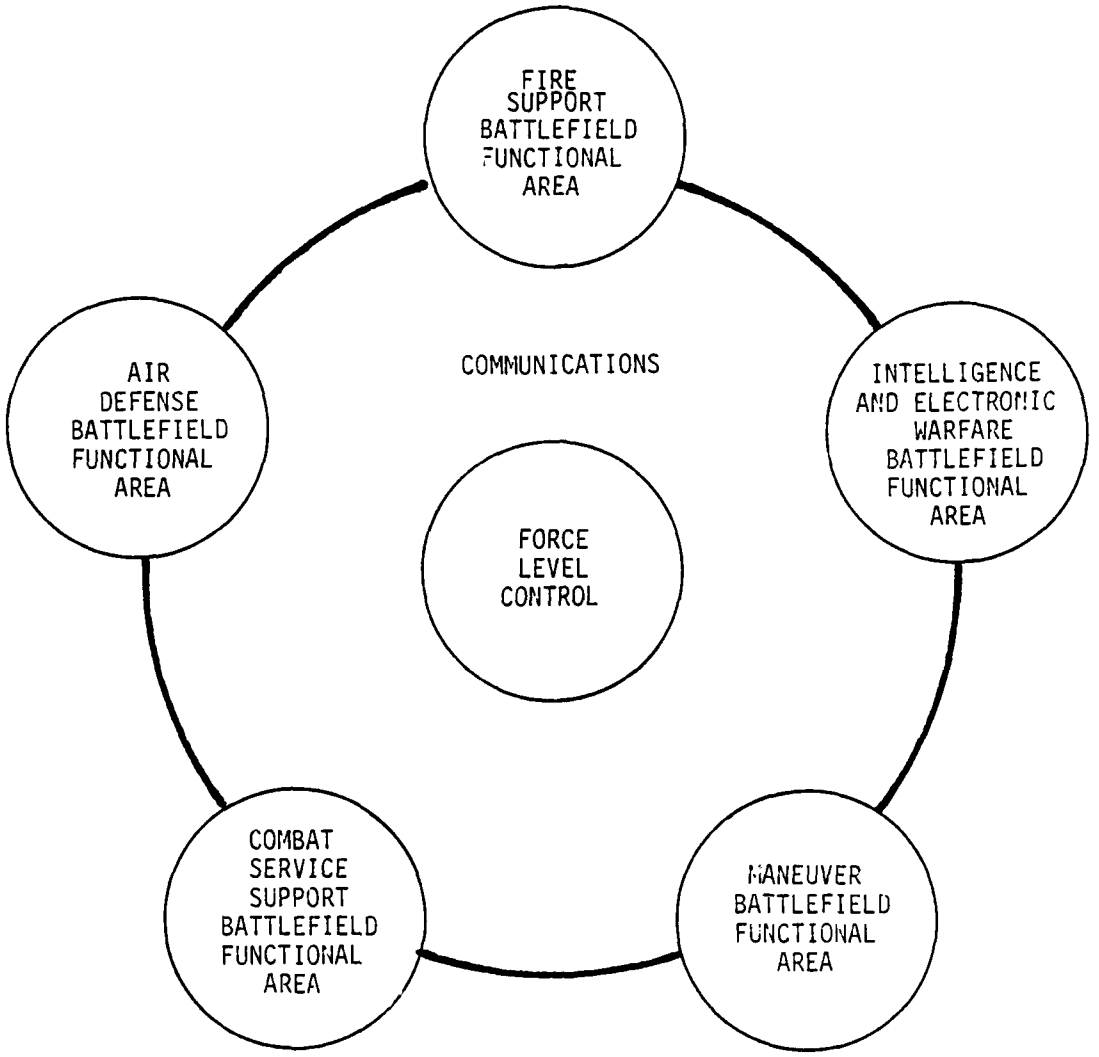

Figure 1. Elements of the battlefield functional area concept

MATERIEL DEVELOPER PDSS CENTERS		
CENTER	LOCATION	MANAGED BY
1	PICATINNY ARSENAL	ARRADCOM
2	FORT MONMOUTH	CORADCOM
3	FORT LEAVENWORTH	CORADCOM
4	FORT BELVOIR*	CSC
5	FORT LEE*	CSC
6	FORT BLISS*	MICOM
7	FORT SILL*	CORADCOM
8	FORT HUACHUCA	ERADCOM
9	FORT MONMOUTH	ERADCOM
10	REDSTONE ARSENAL	MICOM
11	FORT MONMOUTH	AVRADCOM
*Currently operational		

Figure 2. Recommended Materiel Developer PDSS centers

The establishment of PDSS centers at Fort Bliss, Fort Sill, Fort Leavenworth, and Fort Huachuca, as provided for in the PDSS Concept Plan for BAS, satisfies TRADOC's requirement that the PDSS centers for executive/control systems be located with the CD to provide synergism between the Combat and Materiel Developers.

(b) Combat Developer facilities. The PDSS Concept Plan for BAS outlines a concept for establishing CD facilities to provide for the close and continuous relationship which must exist between the CD and MD throughout a system's life cycle. This concept calls for the designation of Combat Development System Managers (CDSM) and the establishment of Combat Development Support Facilities (CDSF) as determined to be needed by TRADOC. The definitions of these terms are presented below, as developed during this current study effort.

1. Combat Development System Manager (CDSM). CDSM is a term used to identify the member of TRADOC who is assigned primary responsibility as the software Combat Developer and the principal Field User's representative for PDSS of a designated system or group of systems within a BFA. The CDSM is responsible for managing/conducting and coordinating all software-related actions inherent in the CD mission. A CDSM will be designated by the commander of the responsible center or school for every BAS for which TRADOC has proponency, prior to the attainment of Milestone II in the system life cycle. The CDSM will normally remain in existence until the system(s) for which he is responsible are phased out of operation. The CDSM may be any combat developments staff officer deemed to be capable of fulfilling the responsibilities of the CDS for a given system or systems. This could be a TRADOC System Manager (TSM) or a member of the TSM's staff if desired, but more likely a member of the combat developments staff.

2. Combat Development Support Facility (CDSF). CDSF is a term used to identify the collection of facilities, equipment, personnel, and operating procedures which provide a CD focal point for addressing PDSS and related matters and together represent the capability of a TRADOC integrating or functional center to fulfill its responsibilities in planning and providing PDSS for BAS. This embodiment of the Combat Developer's PDSS capability may exist, in whole or in part, at a specific location on a continuous basis as a specifically identified part of the TRADOC center's organizational structure or may be formed on an ad hoc basis from resources integral to various organizational elements of the center. The prominence and permanency of CDSFs may vary among TRADOC integrating and functional centers depending upon differences in the magnitude of PDSS requirements and local organizational structure and operating procedures. The nature of the CDSF at any given center may also vary from time to time depending upon changes in PDSS requirements, e.g., changes in the number or life cycle stage(s) of battlefield automated systems for which the center has proponency.

(4) Implementation. Both DARCOM and TRADOC are proceeding with actions directed toward the further development and implementation of the concept plan cited above. This study represents the initial implementation within TRADOC.

b. Objectives.

(1). Overall Study. The objective of this study was to define, in detail, a viable, feasible, and cost effective functional and management structure through which the CD can fulfill his role in planning and providing PDSS for BAS within the framework of Army doctrine and policy, the Army PDSS Concept Plan for BAS and the related functional requirements of the CD. While the PDSS Concept Plan for BAS provides a basic conceptual framework for CD participation in PDSS, the concept must be defined in greater detail to provide a basis for implementation planning within TRADOC.

(2) Phase I. The objective of Phase I was to gain a better understanding of PDSS requirements by identifying and describing the macro-management level and BFA level PDSS processes, associating these with the other CD functions, and identifying the Combat Developer's PDSS requirements, all within the context of the PDSS Concept Plan for BAS.

(3) Phase II. The objective of Phase II was to develop alternative TRADOC systems for fulfilling the CD's responsibilities for planning and providing PDSS for BAS. In pursuit of this objective, the Baseline System and two alternatives were defined. These alternatives were called the Theoretical System, representing a potentially achievable ideal, and the Hybrid System, based on a comparison of the Theoretical and Baseline Systems. These alternatives were designed to provide a basis for TRADOC to either select or derive a preferred alternative.

(4) Phase III. The objective of Phase III was to integrate the results of Phases I and II into an implementation plan for the system selected by TRADOC. Achievement of this objective required the development of a detailed description of the preferred TRADOC PDSS functional and management structure resulting from Phase II, and a plan for transitioning from the present to implementation of the preferred system.

c. Scope.

(1) General. This study focused upon TRADOC's role as the Army's principal CD in planning for and providing PDSS for BAS. Responsibility for PDSS for individual BAS corresponds with the assignment of TRADOC proponency for each system. The categorization of BAS developed during the DARCOM-initiated PDSS study, was also used in this study. This categorization divided BAS as shown below:

- Category 1 - large evolutionary systems

- Category 2A - small evolutionary systems
- Category 2B - large stable systems
- Category 3 - small stable systems.

Primary focus in this study was on Category 1 and 2 BAS in accordance with Study Advisory Group (SAG) guidance. Appendix C of Volume IV, Third Interim Technical Report, lists all BAS addressed in each BFA and identifies the TRADOC proponent for each.

(2) Definitions. Key definitions are listed below to further clarify this scope.

(a) Post-Deployment Software Support (PDSS) is that part of overall system support necessary to sustain, modify, and improve a deployed system's computer software, as defined by the User or his representative. It includes evaluation, development, and timely implementation of system and software modifications to accommodate trouble reports; User proposed changes; and changes to satisfy new or revised doctrinal, tactical, procedural or interoperability requirements. (Source: PDSS Concept Plan for BAS, May 1980)

(b) Battlefield Automated System (BAS) is a system which contains a computer(s), is intended for use by the Army in the field, and which will not function without computer(s); e.g., AN/TSQ-73, TACFIRE. (Source: Assistant Secretary of the Army (RD&A), Memorandum for the Deputy Chief of Staff for Research, Development, and Acquisition, 1 July 1980)

(c) Battlefield Functional Area (BFA) is a conceptual grouping of Army personnel, equipment, and procedures which together perform a major battlefield function. The BFAs used in this study were identified in Figure 1. TRADOC proponency for each BFA is shown in Figure 3. (Derived from Functional Systems on the Corps Battlefield, US Army Combined Arms Combat Development Activity, 13 July 1978)

(3) Relationship of PDSS and the system life cycle. Planning for and provision of PDSS must be accomplished as an integral part of system development and life cycle management. The CD's PDSS planning effort begins with participation in preparation of the Computer Resources Management Plan (CRMP) during the Conceptual Phase as illustrated in Figure 4. Also shown is the period when CD PDSS actions may occur. The time will vary among systems but it is generally accepted that CD PDSS-type actions may be required any time after the system software configuration is frozen for engineering development, and may continue throughout the remainder of the system life cycle. Any changes before the system software configuration is frozen are considered to be part of system development, not PDSS. For those systems being developed under the evolutionary concept authorized by DOD Instruction 5000.2, PDSS planning must begin early in the conceptual stage. PDSS actions for these evolutionary systems will be required beginning with the deployment of the initial developmental version.

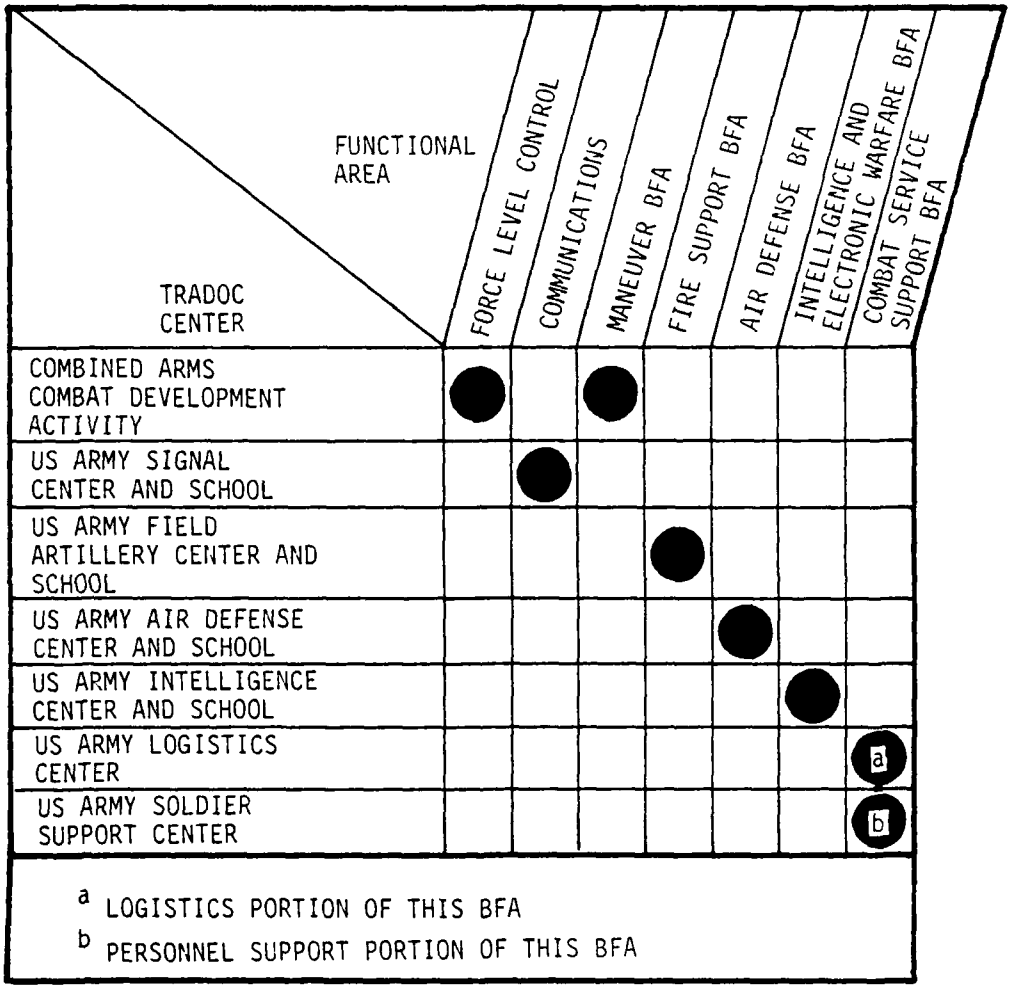

Figure 3. BFA proponency

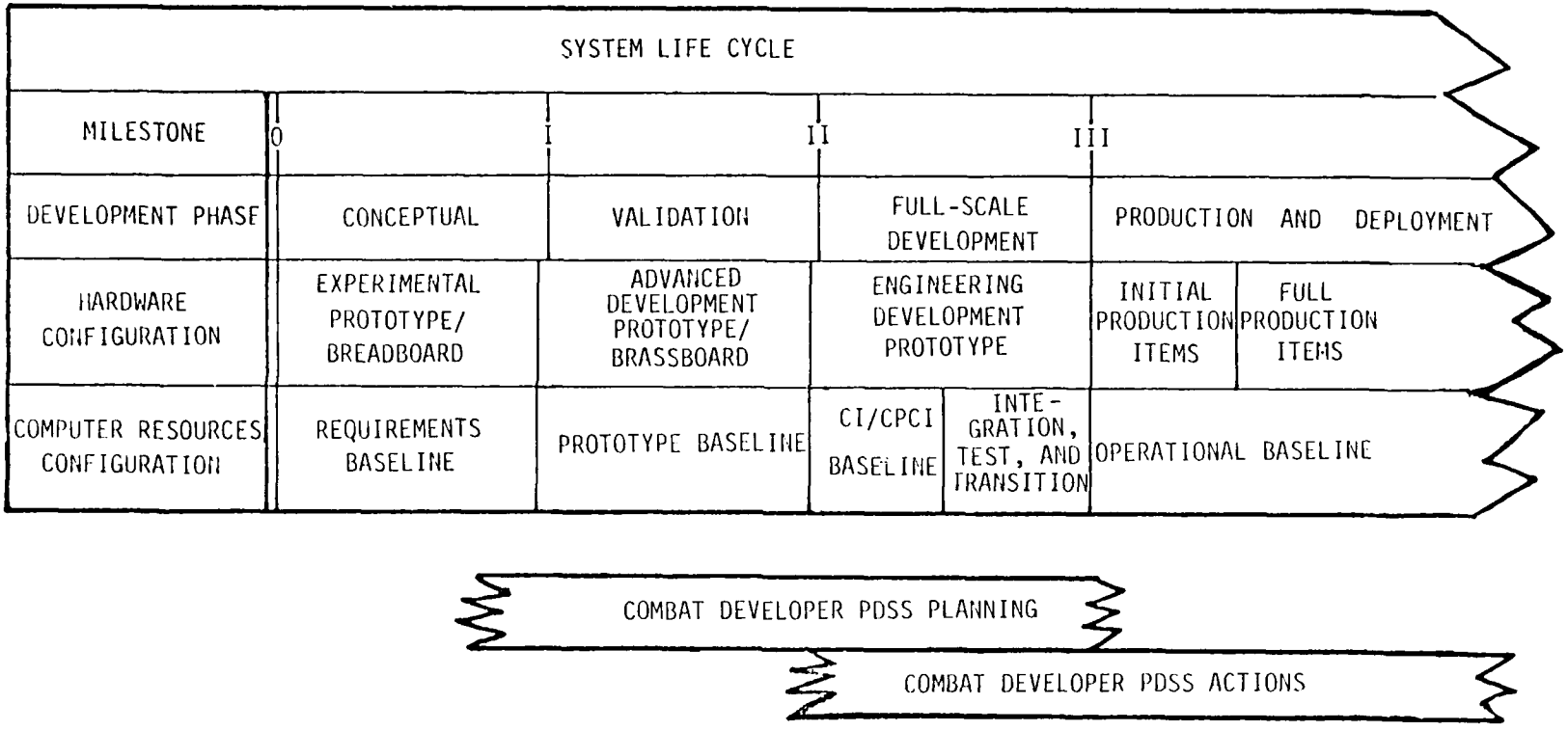

Figure 4. Relationship of PDSS to the system life cycle

(4) Classification. Contract No. MDA903-80-C-0479 under which this study is being conducted states that, "The highest classification involved in the performance of this contract is SECRET". No system whose existence is classified within this level was identified to the study team during the Phase I or II research efforts. If there are systems whose existence is classified above the SECRET level, TRADOC PDSS requirements associated with such systems must be identified and addressed separately.

d. Assumptions.

(1) Missions and PDSS Roles.

(a) The mission and basic role of the MD with respect to PDSS will remain essentially as described in the PDSS Concept Plan for BAS, May 1980.

(b) The mission and basic role of the CD with respect to PDSS will remain essentially as described in the PDSS Concept Plan for BAS, May 1980, and the First Interim Technical Report of the Assessment of the Combat Developer's Role in Post-Deployment Software Support, Volume II, 30 September 1980.

(c) The major functional responsibilities of TRADOC centers and schools will remain essentially as specified in TRADOC Reg. 10-41 and the respective center and school organization and functions regulations.

(2) PDSS Centers. Materiel/System Developer-managed PDSS centers will be established as recommended in the PDSS Concept Plan for BAS, May 1980. The 11 recommended centers were identified in Figure 2.

(3) BAS. BAS addressed in this report will continue to be developed and enter the Army inventory through 1987, generally as currently projected.

e. Methodology.

(1) Study Structure. This study was completed through the accomplishment of eight tasks over an eight month period divided into three phases as shown in Figure 5. The study began 30 June 1980 and was completed 28 February 1981.

(2) Phase I. Phase I began upon contract award. It consisted of Tasks 1 through 4. It addressed the current structure and processes within the Army at the macro- and BFA-levels for performing PDSS, and identified the Combat Developer's PDSS requirements at the BFA level. The methodology employed involved data collection, analysis, and documentation efforts. Data collection was accomplished through (a) an extensive literature review and research effort; (b) visits to 18 Army organizations including elements of the Army Staff, Headquarters, US Army Training and Doctrine Command (TRADOC), five other major commands and field operating agencies, and eight TRADOC

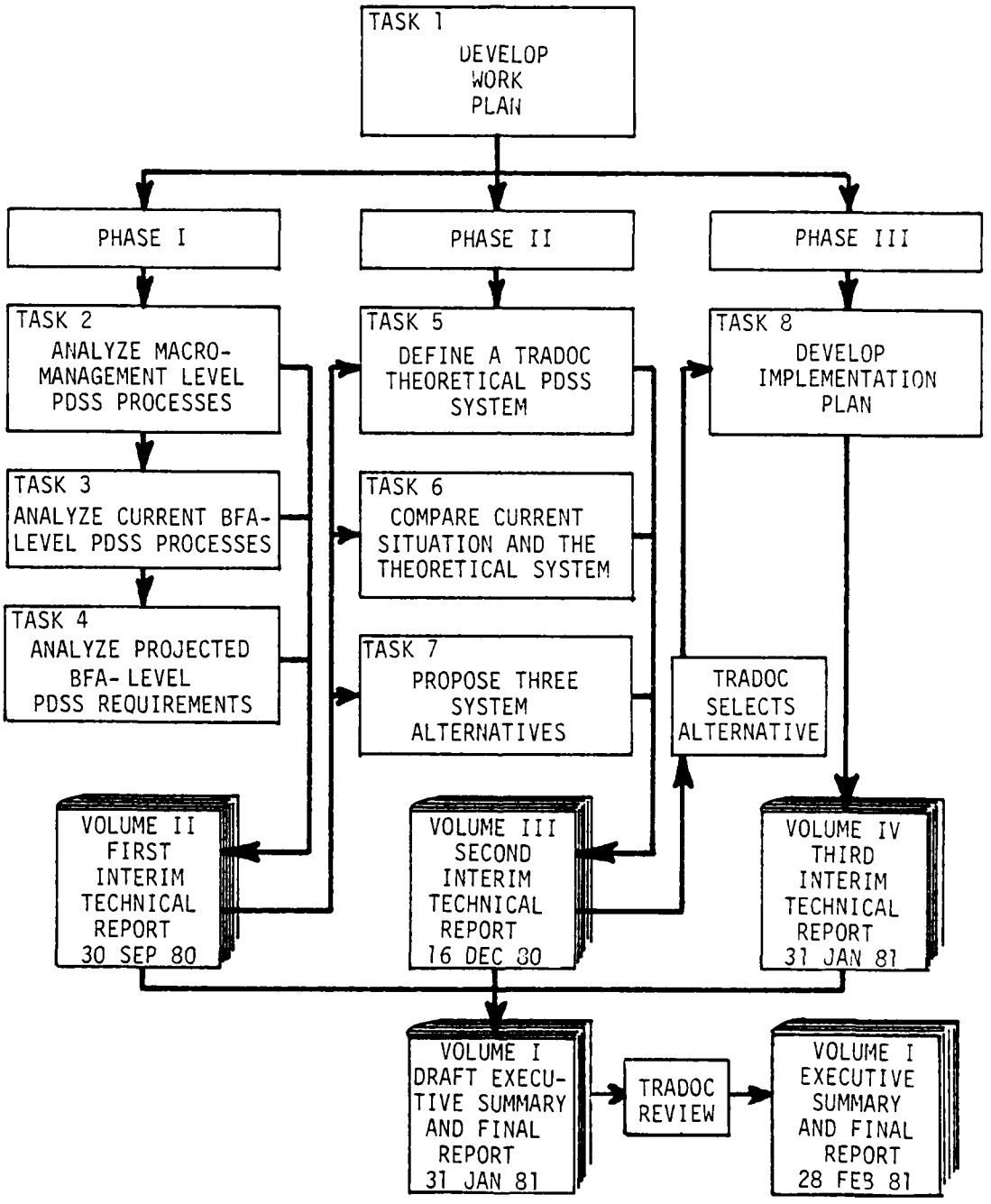

Figure 5. PDSS study overview

centers and schools; and (c) developing and administering a questionnaire designed to obtain detailed information on the BAS being addressed. These data were then collated and analyses of the macro- and BFA-level PDSS processes were developed. A description was also developed of TRADOC's PDSS requirements as perceived by elements of TRADOC Centers responsible for performing the Combat Developer's functions in providing PDSS to BAS. Results of Phase I were documented in Volume II, First Interim Technical Report on the Assessment of the Combat Developer's Role in PDSS, 30 September 1980.

(3) Phase II. Phase II of the study, documented in Volume III, Second Interim Technical Report and consisting of Tasks 5, 6, and 7, was directed toward the definition of the TRADOC Baseline PDSS System and two alternative TRADOC PDSS models or systems that, if implemented, would provide TRADOC a better capability to accomplish its PDSS role. These systems were developed from the PDSS information gained during Phase I, from SAG member feedback, and from further analysis and research during Phase II. The methodology followed in Phase II is illustrated in Figure 6. As indicated, a written description of the Baseline System was prepared first, as a basic point of reference. One of the two alternative systems, called the Theoretical System, was then designed to satisfy all CD PDSS responsibilities, without reference to any resource constraints except that it be a potentially achievable alternative. This Theoretical System was structured and a written description was prepared, working primarily from the BFA center level upwards. Then the Baseline and Theoretical Systems were compared and analyzed for insights on which to base the second of the two alternative systems, called the Hybrid System. Results of Phase II were presented at the SAG Meeting, 17-18 December 1980. The principal purpose of the SAG meeting was to review the system descriptions and either select or derive a final alternative system for use in Phase III so that an implementation plan could be formulated for transitioning from the present to the desired capability.

(4) Phase III. Following receipt of guidance from the Phase II SAG meeting, the Phase III study effort proceeded. The Phase III effort was devoted to the development of the design and a description of the "Objective" PDSS System, and a plan which would provide for transition from the present to implementation of the selected alternative model. This Objective System design and the implementation plan are documented in Volume IV, Third Interim Technical Report.

(5) Executive Summary and Final Report. The Statement of Work called for an Executive Summary and Final Report to be prepared and submitted in draft on 31 January 1981. Following TRADOC review, this report was revised and submitted in final copy on 28 February 1981. This Executive Summary and Final Report contains appropriate introductory and background information, a discussion of the methodology, relevant information from the three Interim Technical Reports to include a brief description of the TRADOC Objective PDSS System, and a discussion of the proposed implementation plan for transitioning from the current situation to the objective system.

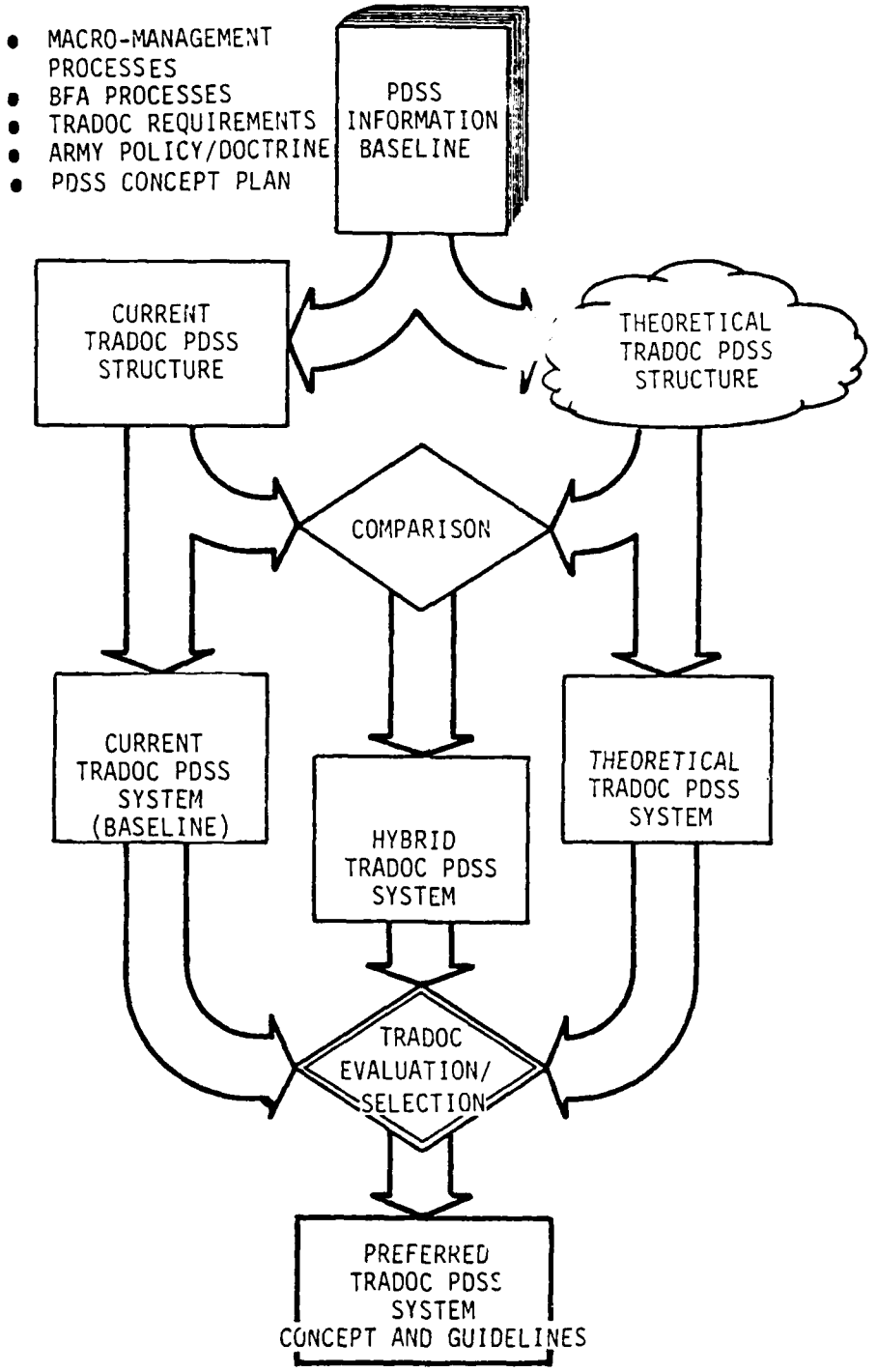

Figure 6. Phase II - TRADOC PDSS alternative concept development

f. Study Documentation. As indicated in Paragraph 3.e. and in Figure 5, results of this study are documented in four volumes as follows:

- Volume I - Executive Summary and Final Report (this document)
- Volume II - First Interim Technical Report, 30 September 1980
- Volume III - Second Interim Technical Report, 16 December 1980
- Volume IV - Third Interim Technical Report, 31 January 1981

g. Analysis. This paragraph contains a discussion of the significant aspects of the research and analyses conducted during Phases I, II, and III, of the Study. This discussion is presented generally in the sequence in which the work was accomplished.

(1) Phase I.

(a) General. Phase I was focused on research and analysis of current macro-management level and BFA-level PDSS processes, and on identification of TRADOC's PDSS responsibilities and functional requirements. The effort devoted to these areas and significant aspects of the results obtained are discussed below.

(b) Macro-management level and BFA-level analyses. These analyses were directed toward identifying the macro- and BFA-level organizations that have PDSS responsibilities and developing descriptions of the processes through which the planning for and provision of PDSS to BAS are accomplished. Research conducted revealed that PDSS is addressed to a very limited degree in current Army regulatory documents and organizational charters. To the extent that it is addressed, it is discussed as an integral part of the system acquisition and life cycle management process. Thus, while this effort focused on PDSS functional responsibilities and associated processes, it was necessary to examine the broader functional areas of system acquisition and life cycle management in order to identify implicit PDSS responsibilities of macro- and BFA-level organizations. The results of this effort are discussed in three general areas:

- The macro- and BFA-level organizational elements involved,
- Applicable regulatory policies and procedures, and
- The battlefield automated systems supported.

1. Macro-management level analysis.

a. Organizations involved. The organizational elements at the macro-management level with principal responsibilities related to PDSS are identified in Figure 7 and discussed briefly below. Only those organiz-

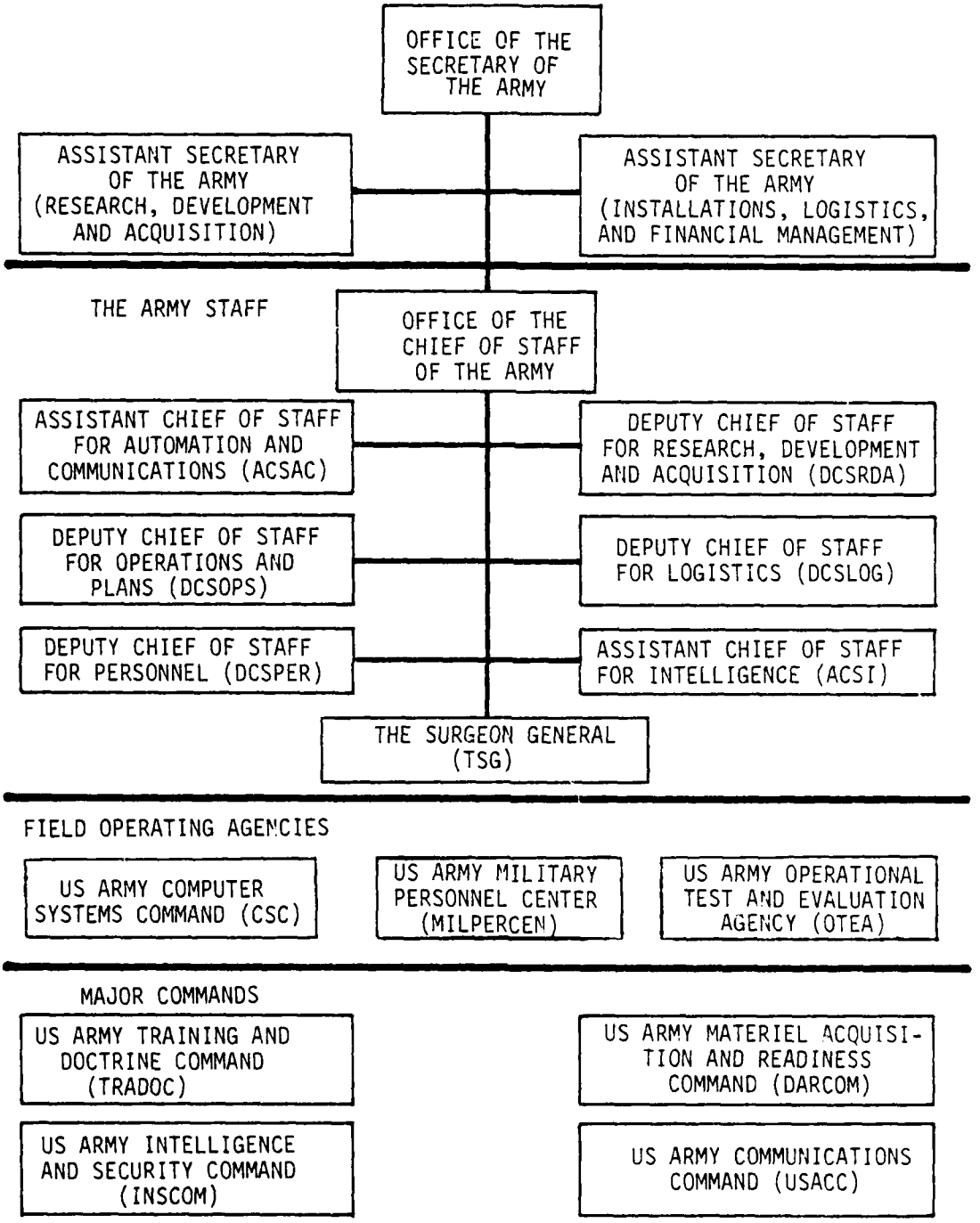

Figure 7. Organizational elements with key PDSS responsibilities at the macro-management level

ations with major responsibilities are addressed since the inclusion of other organizations with minor or supporting PDSS roles would contribute little to this report. More detail on the roles, responsibilities, relationships, and operating procedures of the organizations identified is presented in Paragraphs 2-3 and 2-4 of Volume II, First Interim Technical Report.

b. Role of the macro-management level structure. The role of the Army macro-management level structure with respect to PDSS for BAS is primarily one of establishing and promulgating applicable policy and guidance, and acquiring and allocating resources necessary to provide effective post-deployment support to battlefield systems. This role is carried out at the Headquarters, Department of the Army and major command levels.

No significant gaps or duplications were identified among the mission/responsibility statements of these macro-management level organizations. No changes appear to be needed in organizational missions pertaining to systems acquisition and life cycle management at the macro-management level. However, AR 10-5: Organization and Functions-Department of the Army, needs to be revised and republished to reflect the current responsibilities of the Assistant Chief of Staff for Automation and Communications (ACSAC) and the relationship between the ACSAC, Deputy Chief of Staff for Research, Development, and Acquisition (DCSRDA), the Deputy Chief of Staff for Operations and Plans (DCSOPS), and the Army Force Modernization Coordination Office, in the Army automation functional area. In general, the current missions and functions of the Army Staff and Major Commands (MACOMs) form an acceptable framework for developing an effective PDSS system for BAS.

2. BFA-level analysis. TRADOC is organized the way the Army fights--by battlefield functional area. In consonance with this structure, the Study Team addressed, by battlefield functional area, the organizations within TRADOC that have key roles in planning for or providing PDSS for BAS. Figure 1 identified the major components of this BFA concept. Figure 8 shows these same BFA components and identifies the principal TRADOC organizations within each BFA. Each of these areas is discussed briefly in the paragraphs that follow. Details relative to the way in which the organizations in each area operate at present in planning for and providing PDSS to BAS is discussed in Paragraph 2-4, Functional Area Analysis, of Volume II, First Interim Technical Report.

a. Force Level Control. As indicated in Figure 8, Force Level Control is not one of the five recognized BFAs, but rather it is that process through which a commander exercises his authority in directing, monitoring, and integrating the effort of all organizations and activities in all BFA. Within TRADOC, the Combined Arms Combat Development Activity (CACDA) has proponency for this functional area.

b. Fire Support battlefield functional area. This is the BFA which is the major contributor of fire support to maneuver forces. Within TRADOC, the US Army Field Artillery Center and School has proponency for this BFA.

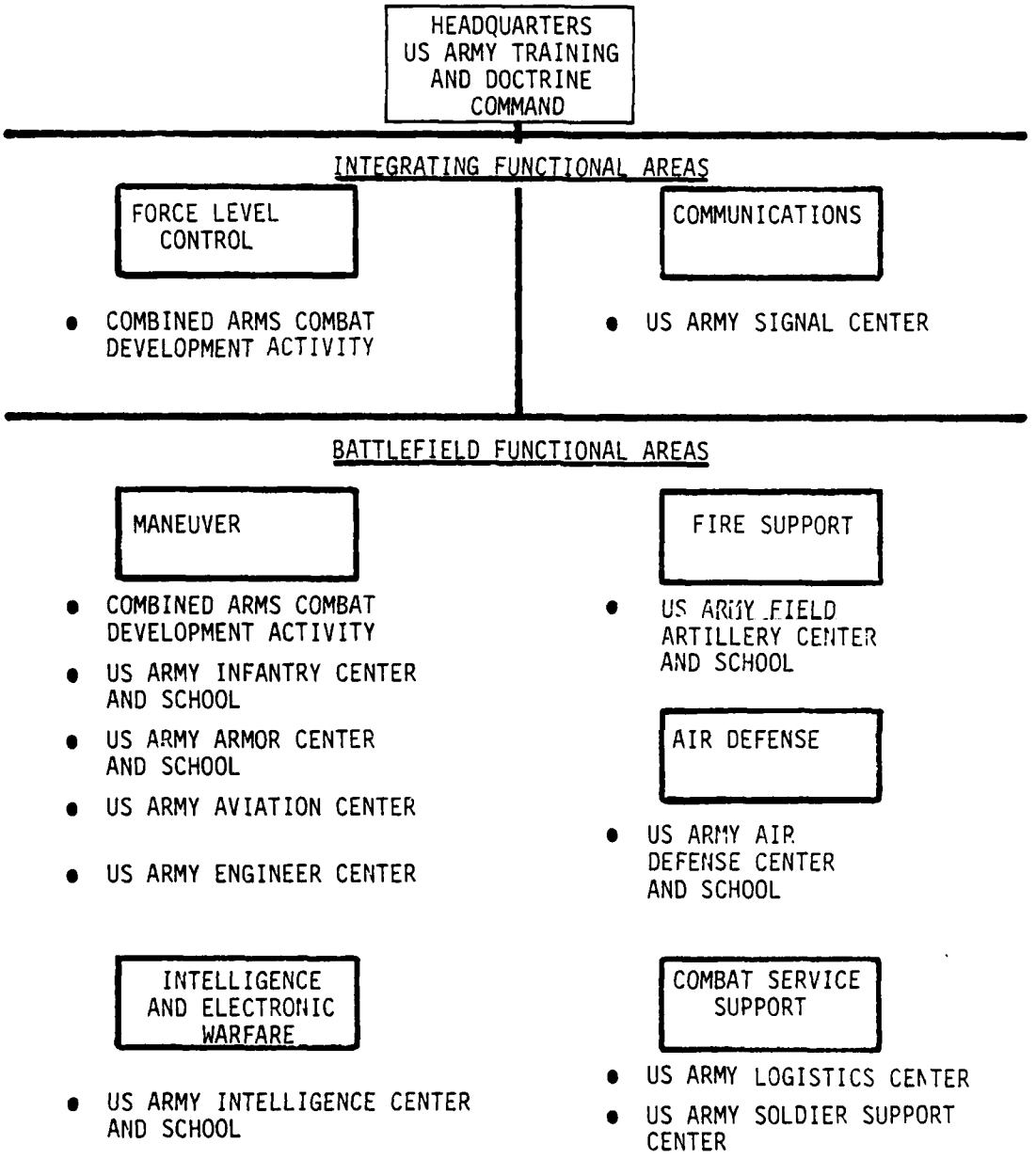

Figure 8. TRADOC organizational elements with key PDSS responsibilities at the BFA level

c. Air Defense battlefield functional area. This is the BFA responsible for reacting to and defeating enemy aircraft and the countermeasures threat under all environmental and tactical conditions in all intensities of combat. The US Army Air Defense Center and School has proponency for this BFA.

d. Intelligence and Electronic Warfare battlefield functional area. The intelligence portion of this BFA assists the commander and his staff in knowing and understanding the enemy and in seeing the battlefield. The electronic warfare element of the BFA is responsible for attacking or defending systems that employ electromagnetic energy, including command and control, weapon, and acquisition systems. The U.S. Army Intelligence Center and School is the TRADOC proponent for this BFA.

e. Combat Service Support battlefield functional area. The two major components of this BFA are logistics and soldier support. The logistics portion of this BFA supports decision making of each tactical echelon by providing decisive and timely logistic and/or technical expertise as far forward as possible to give the tactical commander a full complement of operating equipment and weapons. The soldier support portion of the BFA supports the commander in seeing the battlefield (friendly personnel situation) and in sustaining the forces. Assistance and support is also provided to other BFA and to the soldiers who man them. The US Army Logistics Center is the TRADOC proponent for the logistics portion of the Combat Service Support (CSS) BFA. The US Army Soldier Support Center is the TRADOC proponent for the soldier support portion of the CSS BFA.

f. Maneuver battlefield functional area. This BFA, through its inherent subsystems of direct fire (including subelements of infantry, armor, Army aviation, and air/ground systems), engineer, and integration, provides the timely means to generate and apply decisive combat power on the modern battlefield. CACDA has overall proponency for the Maneuver BFA and is responsible for coordinating and integrating the activities of the US Army Infantry Center and School, the US Army Armor Center and School, the US Army Aviation Center, and the US Army Engineer Center in their respective areas of responsibility.

g. Communications functional area. As illustrated in Figure 8, communications is not one of the five currently recognized BFA, but rather it is that mechanism through which the commander directs and controls all other battlefield functions in the performance of his mission. Communications impacts on and is impacted by all BFA. Within TRADOC, the US Army Signal Center and School is the proponent for the communications functional area. CACDA has responsibility for coordinating the integration of actions in the communications area with those in all other BFA.

3. Regulatory policy. The study effort that was devoted to regulatory policy relevant to PDSS involved the review and analysis of more than seventy-five Department of Defense (DOD) Department of the Army,

Field Operating Agency, Major Command, and TRADOC Center and School directives, instructions, regulations, and pamphlets. The results of this effort are discussed below.

a. Applicable regulations. Current Army policy applicable to system acquisition and life cycle management (to include post-deployment support of BAS) is contained in ARs 1000-1, 70-1, and 18-1.

AR 1000-1 contains basic policy for system acquisition and life cycle management. The AR 70-series provides additional details necessary to implement AR 1000-1. These regulations, which are issued under the proponency of DCSRDA and the control of the Assistant Secretary of the Army (Research, Development and Acquisition), implement the basic Department of Defense and Office of Management and Budget procurement policies. They are applicable to the acquisition of all BAS addressed in this study except those involving commercial, general purpose automatic data processing systems which must be acquired under AR 18-1.

AR 18-1 governs the acquisition of these latter systems, in accordance with DOD directives and provisions of Public Law 89-306 (The Brooks Bill). This bill prescribes special management requirements and procedures intended to ensure the economic and effective purchase, lease, maintenance, operation, and utilization of commercial ADP equipment. The ACSAC is the Army Staff proponent for AR 18-1 which is under the supervision of the Assistant Secretary of the Army (Installations, Logistics and Financial Management).

Thus, two separate and distinct sets of policy documents exist (AR 1000-1/AR 70-1 and AR 18-1) that are applicable to the acquisition and life cycle management of BAS.

b. Implications.

This dual set of policy documents has implications with respect to the BAS addressed in this study. In general, the USACSC-developed systems for which the Logistics Center or the Soldier Support Center has Combat Developer proponency are developed under provisions of AR 18-1 while other BAS are developed under AR 1000-1 and the AR 70-series. However, there are some differences of opinion regarding the applicability and scope of these regulations. Efforts are being made through the recent revision of AR 18-1 and the revisions currently being made to ARs 1000-1 and 70-1 to clarify the applicability of each set of regulations and to harmonize the requirements and procedures of each. To the extent that this effort is successful, it should eliminate problems resulting from different interpretation and perceived disparities in the provisions and applicability of these policy documents at the macro-management level.

Also bearing directly on this subject is the memorandum from the Assistant Secretary of the Army (RDA), 1 July 1980, subject: Standardization of Embedded Computer Resources, and the TRADOC implementing letter from the

Deputy Commander, TRADOC, 30 July 1980. When implemented, the policy and guidance contained in these two documents will provide for more standardized system development and support procedures within TRADOC.

c. Adequacy.

A serious inadequacy of Army regulatory documents has been that while purporting to address the entire life cycle of a system from initiation through development and deployment to eventual disposal upon obsolescence, little emphasis is placed on post-deployment support in general or on post-deployment software support in particular. So great has been the need for additional policy and guidance in this area that, in the absence of an Army Regulation, DARCOM proceeded to publish DARCOM Regulation 70-16: Management of Computer Resources in Battlefield Automated Systems. This DARCOM regulation provides, among other things for the documentation of PDSS requirements, plans, and resource estimates early in the acquisition phase.

With respect to improving Army regulations which address this area, the new AR 18-1 does place increased emphasis on the Deployment and Operation Phase of the system life cycle. However, changes are also needed in ARs 70-1 and 1000-1 to provide for appropriate attention to PDSS and to preclude the type of difficulties experienced by Users as a result of system deficiencies and inadequate support planning to accomplish corrective actions and needed system improvements. Review of a new draft chapter to be incorporated into revised AR 70-1 indicates this problem is being addressed and that adequate guidance will exist after publication of the new AR 70-1. Following revision to ARs 1000-1 and 70-1, DA Pamphlet 11-25 will need to be revised to correspond with the revised regulatory provisions.

A TRADOC regulation is also needed, comparable to DARCOM Reg. 70-16, to provide command policy with respect to planning and performing PDSS.

4. Battlefield automated systems to be addressed.

a. Identification of systems. The portion of this study effort devoted to identification of the BAS for which TRADOC has Combat Developer PDSS responsibilities began with a review of systems identified in the PDSS Concept Plan for BAS, May 1980. That study report identified 110 BAS that are deployed or projected for deployment during the next several years. Of these systems, 6 were designated Category 1, 27 Category 2A or 2B, and 58 Category 3.* Nineteen USACSC-developed systems, included in the 110, were not categorized, but for planning purposes were considered to be Category 2. Further analysis of these BAS during this TRADOC study resulted in some modification to the original listing in the PDSS Concept Plan for BAS. These modifications were made primarily to reflect new decisions to initiate, terminate, or change various system design and development programs. The numbers of BAS resulting from this analysis are shown by BFA and by category in Figure 9. Details pertaining to each BAS are presented in Appendix C of Volume IV, Third Interim Technical Report.

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* See pages 6 and 7 for definitions.

FUNCTIONAL AREA OR BFA	NUMBER OF SYSTEMS				
	CATEGORY 1	CATEGORY 2	CATEGORY 3	CSC	TOTAL
FORCE LEVEL CONTROL	1				1
MANEUVER		1	14		15
FIRE SUPPORT	1	2	14		17
AIR DEFENSE	2	3	2		7
INTELLIGENCE/EW	1	7	11		19
COMBAT SERVICE SUPPORT	1		2	24	28
COMMUNICATIONS	2	8	14	1	25
TOTAL	8	21	57	25	110

Figure 9. BAS by category and functional area

b. Addressal of BAS in this report. While all 112 BAS shown in Figure 9 have been addressed to some extent during this study, the SAG guidance provided that the Study Team's effort should be focused primarily on Category 1 and 2 and USACSC systems. This guidance results from TRADOC being principally concerned with software in these large and/or evolutionary systems. Software in Category 3 systems is not expected to change significantly once the system is fielded. Thus, primary effort during this study was focused on the 29 Category 1 and 2 systems and the 26 USACSC systems shown in Figure 9.

(c) TRADOC PDSS responsibilities and functional requirements. Analysis conducted by the Study Team during this portion of the Phase I effort revealed that TRADOC, as the Army's principal Combat Developer, has a critical and increasing role in the development and life cycle management and support processes for battlefield automated systems. There are several reasons for the increase in this role but the driving factors are:

- The growing trend toward embedding more doctrine, tactics, and functional procedures in BAS software, thus necessitating more direct CD participation in analysis and decisions pertaining to system changes that could affect any of these areas,
- The growing number of BAS being fielded which makes definition and maintenance of functional interoperability requirements more complex, and
- The continually evolving nature of some BAS which is an accepted system development approach per DODI 5000.2, but which has major implications for System and Combat Developers, Users, and all system support activities.

Fulfillment of this increased role in PDSS for BAS imposes additional functional requirements on HQ TRADOC and all TRADOC centers and schools involved in supporting battlefield systems. These PDSS-related functional responsibilities derive primarily from TRADOC's basic responsibilities as set forth in AR 10-41: Organization and Functions, US Army Training and Doctrine Command, which are expanded upon in other applicable Army and TRADOC regulatory documents. Within the scope of these TRADOC regulatory responsibilities, the Study Team identified specific CD PDSS functional requirements. In structuring this set of CD PDSS functional requirements, the Study Team drew upon the minimum set of tasks necessary for PDSS as shown in Figure 10. Some of these tasks are applicable only to the MD, some only to the CD, and some to both. Analysis of this set of minimum PDSS tasks, TRADOC's basic regulatory responsibilities, and the role of TRADOC as the Army's principal Combat Developer, provided a basis for formulating a set of PDSS functional requirements generally common to all TRADOC centers and schools involved with PDSS for BAS. These functional requirements are presented in Figure 11, grouped into the same six functional task areas as shown in Figure 10. Again, while most of these functional requirements are common to all centers and schools, their magnitude varies among these TRADOC organizations.

1. Management

   a. Development and maintenance of a software support plan responsive to user requirements as determined by the user representative (for example, TRADOC center or school)

   b. Planning, acquisition, and maintenance of resources

   c. Operation of the PDSS centers/support facilities

   d. Configuration management of the software system.

2. Analysis

   a. Analysis of a system to determine the nature of the problem -- whether hardware, software or both

   b. Analysis of software problem reports

   c. Analysis of proposed system changes to determine technical, operational, resource, and schedule impacts

   d. Analysis of support software changes due to hardware variations

   e. Determination of the possible impact of software changes on hardware/software

   f. Analysis of system changes due to interoperability requirements.

   g. Analysis of conceptual changes to fielded systems, such as doctrine, tactics, operating procedures, command and control, organizational concepts, training, and logistics.

3. Modification

   a. Development of system/software change requirements

Figure 10. Minimum set of tasks necessary for PDSS*
(Continued on next page)

* As defined in the PDSS Concept Plan for BAS, May 1980

b. Development, design, implementation, and documentation of all software modifications

c. Maintenance of documentation necessary to support existing software and development systems

d. Distribution of changes in accordance with the Configuration Management Plan

e. Compliance with approved design standards

f. Compliance with approved programming standards

g. Compliance with approved documentation standards

4. Test

a. Verification and validation of software and system changes

b. Testing and evaluation of the impact of changes on the operational function

c. User acceptance testing, including evaluation of operational suitability and operational effectiveness.

5. Field Support

a. Provision of field support, including development and guidance to the field on operation and employment of the systems

b. Maintenance of communication and procedures between the field and support activity.

6. Other

a. Development of system test and analysis software/hardware

b. Development and maintenance of simulations and emulations, where required

Figure 10. (continued)

c. Development and conduct of the training necessary to introduce new software versions and maintain old systems

d. Development and distribution of procedural, operational, training, and maintenance documentation and special operating instructions.

Figure 10. (concluded)

TASK AREA	TRADOC RESPONSIBILITY	FUNCTIONS
1. MANAGEMENT	1. PARTICIPATE WITH MD IN DEVELOPING AND MAINTAINING PDSS PLANS FOR EACH BAS.	1. PARTICIPATE IN DEVELOPMENT OF THE CRMP. 2. PROVIDE REPRESENTATION ON THE CRWG. 3. PARTICIPATE IN DESIGNATION OF PDSS CENTER FOR EACH BAS.
	2. PARTICIPATE WITH MD IN CONFIGURATION MANAGEMENT.	1. PROVIDE REPRESENTATION ON EACH BAS CCB. 2. PROVIDE REPRESENTATION ON EACH BAS SSCB. 3. PROVIDE REPRESENTATION ON EACH BAS FSCB. 4. PROVIDE REPRESENTATION ON ANY EXECUTIVE LEVEL CCB ESTABLISHED UNDER THE C^2CS CONCEPT.
	3. MANAGE CD PDSS EFFORT.	1. DETERMINE REQUIREMENTS (PERSONNEL, EQUIPMENT, FACILITIES, SIMULATION MODELS AND DEVICES, DATA BASES). 2. PLAN AND PROGRAM FOR RESOURCES. 3. ACQUIRE AND MANAGE RESOURCES.
2. ANALYSIS	1. PERFORM ANALYSIS OF BAS SOFTWARE PROBLEM REPORTS.	1. IN CONJUNCTION WITH MD, DETERMINE IF SOURCE OF PROBLEM IS FUNCTIONAL OR TECHNICAL. 2. COORDINATE WITH MD ON ACTION REQUIRED TO ADDRESS THE PROBLEM. 3. COORDINATE WITH MD IN NOTIFYING THE USER OF RECEIPT AND PLAN OF ACTION ON TROUBLE REPORTS. 4. COORDINATE WITH MD ON PROVIDING SOLUTION TO THE FIELD. 5. ESTABLISH, IN COORDINATION WITH MD, PRIORITY OF CHANGE AND TIME FRAME FOR CHANGE TO BE EFFECTED.
	2. ANALYZE USER-STATED REQUIREMENTS.	1. RECEIVE REQUIREMENT FROM USER. 2. EXAMINE BASIS FOR REQUIREMENT. 3. COORDINATE WITH MD REGARDING ACTION TO SATISFY VALIDATED REQUIREMENTS. 4. INFORM USER OF PLANNED DISPOSITION OF REQUIREMENT.
	3. ANALYZE FUNCTIONAL IMPACT OF CONCEPTUAL CHANGES ON SYSTEMS (E.G., CHANGES IN DOCTRINE TACTICS, OPERATING PROCEDURES, COMMAND AND CONTROL, ORGANIZATIONAL CONCEPTS, TECHNOLOGY, THREAT).	1. DETERMINE AND EXAMINE, IMPACT ON INDIVIDUAL SYSTEMS AFFECTED. 2. DETERMINE AND EXAMINE IMPACT ON SYSTEM INTEROPERABILITY BASELINE.

Figure 11. TRADOC PDSS responsibilities and functions
(continued on next page)

TASK AREA	TRADOC RESPONSIBILITY	FUNCTIONS
2. ANALYSIS (CONTINUED)	4. ANALYZE FUNCTIONAL IMPACT OF PROPOSED SYSTEM CHANGES.	1. IDENTIFY OPERATIONAL IMPACT. 2. IDENTIFY USER-RESOURCE REQUIREMENT IMPACT. 3. IDENTIFY TRAINING IMPACT. 4. IDENTIFY LOGISTICAL IMPACT. 5. IDENTIFY IMPACT ON ALL PERSONNEL ASPECTS. 6. IDENTIFY HUMAN FACTORS IMPACT. 7. IDENTIFY SYSTEM INTEROPERABILITY IMPACT.
3. SYSTEM MODIFICATION	1. DEVELOP FUNCTIONAL CHANGE REQUIREMENT.	1. DEFINE REQUIREMENT IN APPROPRIATE REQUIREMENTS DOCUMENT. 2. SPECIFY ANY INTEROPERABILITY CHANGE REQUIREMENT. 3. PROVIDE REQUIREMENT TO MD. 4. COORDINATE WITH MD IN ESTABLISHING CHANGE PRIORITIES AND OBJECTIVE IOC DATE. 5. MAINTAIN COORDINATION WITH MD DURING DEVELOPMENT OF CHANGE TO CLARIFY REQUIREMENTS AS REQUIRED.
4. SYSTEM TESTING	1. MONITOR, PARTICIPATE IN, OR CONDUCT SYSTEM TESTING AS APPROPRIATE.	1. COORDINATE TYPE/DEGREE OF TESTING NECESSARY FOR EACH ISSUE/REVISION OF SOFTWARE PROGRAM. 2. DEVELOP SYSTEM CHANGE TEST CONDITIONS AND CRITERIA. 3. PARTICIPATE IN DESIGN OF THREAT SCENARIOS. 4. MONITOR DEVELOPMENT TEST (DT). 5. PARTICIPATE AS TASKED BY HQDA IN OPERATIONAL TESTING (OT) CONDUCTED BY OTEA. 6. PLAN AND CONDUCT OTHER SYSTEM OT. 7. PLAN AND CONDUCT OR MONITOR USER ACCEPTANCE TESTING 8. EVALUATE OPERATIONAL SUITABILITY AND EFFECTIVENESS. 9. PROVIDE APPROVAL FOR SOFTWARE RELEASE TO THE FIELD.
5. FIELD SUPPORT	1. MAINTAIN INTERFACE WITH AND PROVIDE FUNCTIONAL GUIDANCE TO FIELD USERS	1. MAINTAIN COMMUNICATIONS WITH USERS. 2. FUNCTION AS USER SURROGATE. 3. DEVELOP AND PROVIDE GUIDANCE ON DOCTRINAL/ TACTICAL ASPECTS OF SYSTEM EMPLOYMENT. 4. COORDINATE WITH MD ON THE SCHEDULE AND METHODOLOGY FOR DISTRIBUTION OF SYSTEM SOFTWARE CHANGE PACKAGE TO THE FIELD.

Figure 11. (continued)

TASK AREA	TRADOC RESPONSIBILITY	FUNCTIONS
5. FIELD SUPPORT (CONTINUED)	2. DEVELOP AND MANAGE TRAINING PROGRAM REQUIRED BY SYSTEM CHANGE (EXCEPT FOR NEW EQUIPMENT TRAINING (NET)).	1. DETERMINE TRAINING/RETRAINING DEVELOPMENT REQUIREMENTS. 2. DETERMINE TRAINING DEVICE REQUIREMENTS. 3. DEVELOP TRAINING PLAN FOR MEETING REQUIREMENTS. 4. DEVELOP AND DISTRIBUTE UPDATED OR NEW TRAINING LITERATURE AND MATERIALS. 5. DEVELOP TRAINING SCENARIOS FOR INSTITUTION AND FIELD USE. 6. DEVELOP TRAINING SUPPORT SOFTWARE REQUIREMENTS. 7. VALIDATE/VERIFY TRAINING MATERIALS. 8. PARTICIPATE IN FIELD USER TRAINING AND NET.
6. OTHER	1. JOINT AND INTERNATIONAL INTEROPERABILITY REQUIREMENTS	1. IDENTIFY REQUIREMENTS. 2. SPECIFY IN REQUIREMENTS DOCUMENT.
	2. SUPPORT TO CONTINGENCY PLANNING.	1. COORDINATE WITH MD IN PLANNING FOR REQUIRED PDSS SUPPORT TO BAS IN THE CONTINGENCY FORCE. 2. PROVIDE FOR "TACTICAL TAILORING" OF FIELDED SOFTWARE TO CONTINGENCY MISSION.
	3. SUPPORT TO CRISIS/WARTIME OPERATIONS.	1. SPECIFY PDSS RESPONSE REQUIREMENTS. 2. EXAMINE ALTERNATIVES FOR PROVIDING THE MOST TIMELY AND EFFECTIVE PDSS UNDER VARIOUS SCENARIOS. 3. COORDINATE WITH THE MD IN PLANNING PDSS SUPPORT. 4. DEVELOP PROCEDURAL WORK-AROUNDS WHEN SITUATION DOES NOT PERMIT SOFTWARE CHANGES. 5. THROUGH FRONT-END ANALYSIS, DESIGN FLEXIBILITY INTO THE SOFTWARE TO ALLOW FIELD USER RESPONSE TO ANTICIPATED CONTINGENCIES.
	4. ASSESS CONTINUED TACTICAL SUITABILITY OF BAS.	1. CONDUCT PERIODIC REEVALUATIONS OF BAS TO DETERMINE CONTINUED TACTICAL SUITABILITY AS CHANGES OCCUR IN THREAT, DOCTRINE, AND OPERATIONAL REQUIREMENTS.

Figure 11. (concluded)

(2) Phase II. As discussed in the methodology, Paragraph 3.e., this phase of the study was conducted to develop alternative TRADOC functional and management PDSS models or systems for fulfilling the Combat Developer's responsibilities for planning and providing PDSS to BAS. In pursuit of this objective, the Baseline and two alternative systems were defined for TRADOC consideration. These alternatives were called the Theoretical System, representing a potentially achievable ideal, and the Hybrid System, derived from a comparative analysis of the Theoretical and Baseline Systems. A brief discussion of each of these alternatives and the results of the TRADOC SAG review are presented in the paragraphs that follow:

(a) The Baseline System.

1. System descriptions. The Baseline System description was developed based primarily on information obtained during Phase I, supplemented by additional research and input from SAG members during Phase II. This system was described within the context of the BFA concept, and identified organizational elements involved with PDSS to the branch or separate office level within each TRADOC functional center and school that currently has CD PDSS responsibilities for one or more BAS. These centers and schools involved in the Baseline System and the number of BAS for which they have proponency are shown in Figure 12.

2. Baseline analysis. Analysis of this Baseline revealed that, to the extent that PDSS was being accomplished within TRADOC, it was being performed as an integral part of the system development and life cycle management process under the combat developments mission. However, this analysis also revealed that resources available in the Baseline System were not adequate to permit TRADOC organizations to accomplish those CD PDSS functions for which they are responsible. Based on this analysis, the Study Team developed estimates of additional personnel resources that need to be added to the Baseline to provide a minimally acceptable capability to perform essential PDSS functions. These additional resources are needed to provide a capability to accomplish important CD PDSS functions not presently being performed for BAS already fielded, and to provide PDSS for additional BAS projected for deployment through 1987. Chapter 2 and Appendix D of Volume III, Second Interim Technical Report, contain this Baseline System description.

(b) The Theoretical System. The Study Team's effort focused next on design of a TRADOC Theoretical PDSS System which would, if implemented, provide a capability to accomplish all currently identified CD PDSS functions for all BAS projected for deployment through 1987. This system was also designed within the context of the BFA concept and described to the branch or separate office level of detail.

1. Design guidelines. The principal guidelines and other considerations that were followed in designing this Theoretical PDSS System are summarized below:

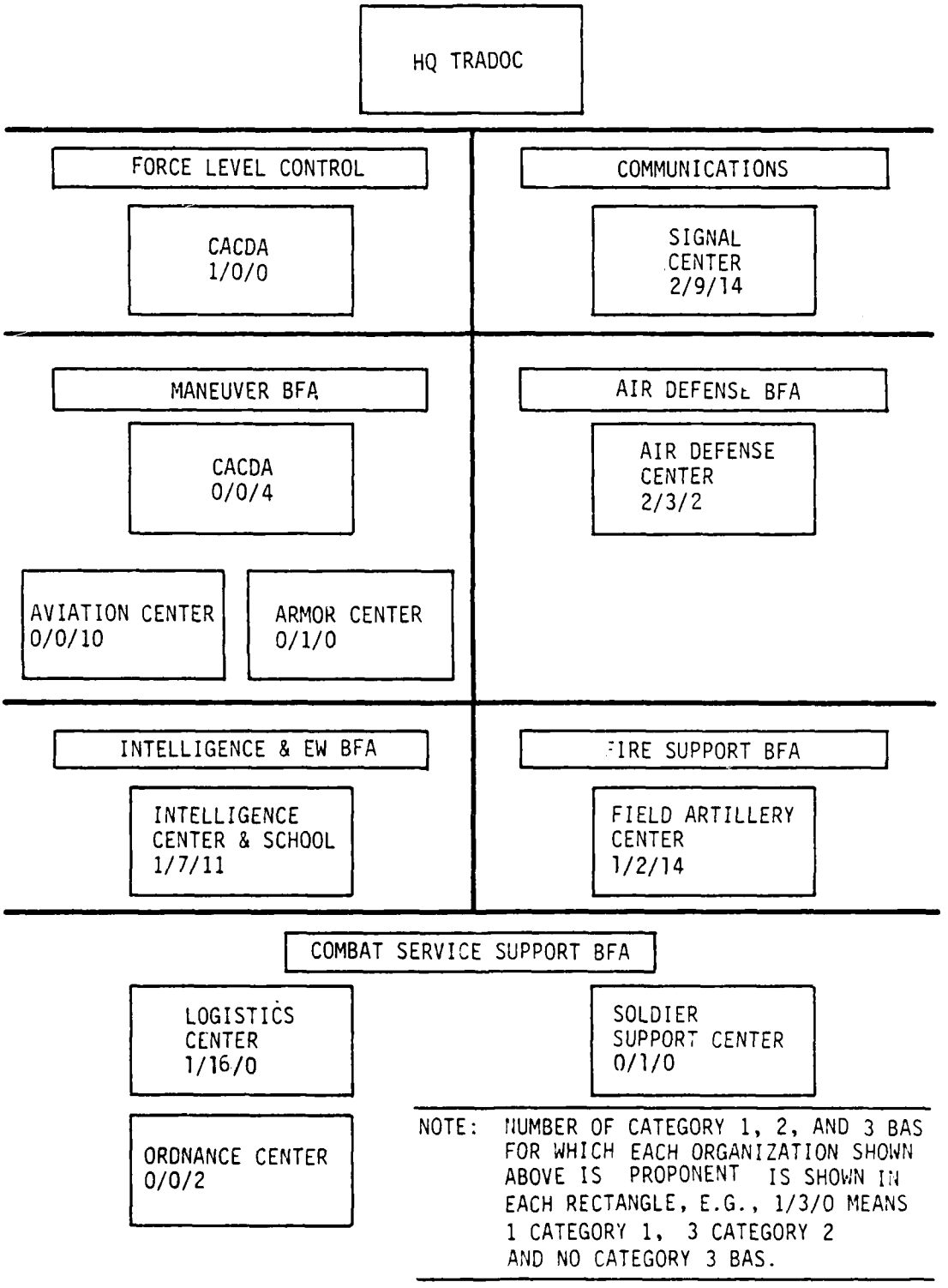


Figure 12. TRADOC organizations by BFA which require a POSS capability

a. Focus on the future. The focus of the study team in designing this Theoretical System was on the future. This approach was adopted to ensure that appropriate consideration would be devoted to known future PDSS requirements and to allow adequate time for TRADOC to integrate its system implementation effort with the Army's Planning, Programming, and Budgeting System.

b. Applicability of current policy.

- The Theoretical System is to be bounded by current Army regulations and the PDSS Concept Plan for BAS.
- The Theoretical System is to be in consonance with TRADOC Regs. 10-5 and 10-41, the BFA concept, and the Command, Control, and Subordinate Systems (CCS^2) Concept.

c. Resources. The System will not be constrained by resources.

d. Addressal of requirements. The System must provide for an adequate PDSS capability at each TRADOC center and school determined, during Phase I and during definition of the Baseline System, to have PDSS responsibilities for one or more BAS.

2. Definition of the required capability. Having identified during Phase I what PDSS requirements must be satisfied, the Study Team proceeded to determine what capability is needed to meet the requirements. Capability was addressed in terms of organizational elements and their resources. Resources were matched to workload according to the TRADOC 11-series of regulations and pamphlets to the extent possible. This effort focused on tailoring each system component or element to the needs of the local parent center or school organization. Personnel, major equipment, and physical facility requirements were addressed.

3. Results of the design effort. The result of this effort was a system, which would, if implemented, provide the required PDSS capability at HQ TRADOC and at each TRADOC center and school shown in Figure 12. The capability was tailored to the needs of each center and school but, in all cases, it was designed to become an integral part of, and function under, the Directorate of Combat Developments or the Management Information Systems Directorate at each center and school. This design would be consistent with current operational concepts and would minimize changes to the existing organizational structure and operating procedures. Resources needed to implement the system were projected through 1987, in accordance with current PDSS requirements and projected requirements associated with planned deployment of new BAS or the further extension of existing BAS. This Theoretical PDSS System is discussed in detail in Chapter 3 and Appendix E, Volume III, Second Interim Technical Report.

(c) The Hybrid System

1. Basis for the system design. As indicated in the discussion of the methodology in Paragraph 3.e., a comparative analysis was made of the Baseline and Theoretical Systems to evaluate these systems and provide a basis for designing another alternative called the Hybrid System.

2. Results of the comparison and design effort. This comparison revealed that the Theoretical System offered advantages over the Baseline in virtually all areas of comparison except in resources required. Thus, while the resultant Hybrid System incorporates desirable features of both the Baseline and Theoretical Systems, it is heavily oriented toward the Theoretical System. It would provide for the establishment of a capability at each TRADOC center and school shown in Figure 12. The organizational alignment and relationships of the elements of this Hybrid System were essentially the same as those discussed in connection with the Theoretical System in Paragraph (b) above. As in the case of the Theoretical System, no specific resource constraints were imposed on design of the Hybrid System. However, a conscientious effort was made to reduce resource requirements through consolidation of responsibilities and sharing of capabilities without severely degrading the capability of the resulting system. The result was a Hybrid System that would, if implemented, provide a capability significantly greater than the Baseline and comparable to that of the Theoretical System in most functional areas, with some reduction in resources. Details of the Hybrid System are presented in Chapter 5 and Appendix F of Volume III, Second Interim Technical Report.

(d) Comparison of resource requirements. A comparison of the personnel estimated to be required to enhance the Baseline System as discussed in Paragraph (a) above, and to fully implement the Theoretical and Hybrid Systems in 1987 is shown in Figure 13. Further details on resource requirements associated with each system are presented in Chapters 2, 3, and 5, Volume III, Second Interim Technical Report.

(3) Phase III. The Study Team's efforts during Phase III were devoted to the development of a description of the TRADOC Preferred or "Objective" PDSS System and the preparation of a plan for transitioning from the present situation to implementation of the Objective System. Each of these efforts are discussed below.

(a) The TRADOC Objective PDSS System. The description of the TRADOC Objective PDSS System was developed by the Study Team based on guidance provided by the SAG, following its review of the TRADOC PDSS Baseline, Theoretical, and Hybrid System alternatives which were presented at the Phase Ii SAG Meeting, 17-18 December 1980. This Objective PDSS System incorporates desirable features and capabilities of the organizational structure and operating procedures of the current Baseline as well as the proposed Theoretical and Hybrid System alternatives developed during Phase II. The result is an Objective System, tailored to the PDSS-capability requirements

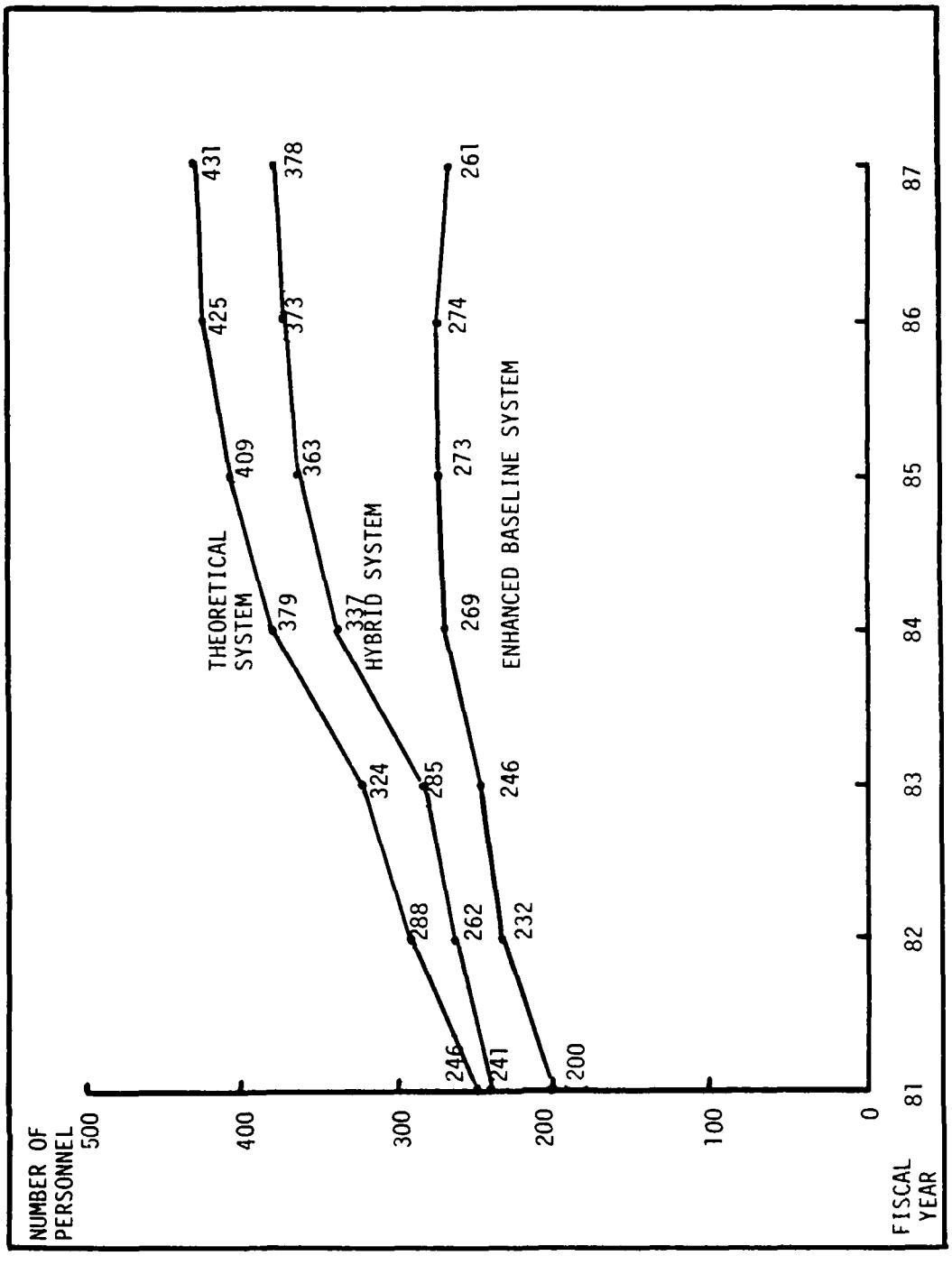


Figure 13. Comparison of estimated personnel requirements

of HQ TRADOC and each integrating and functional center with significant CD responsibilities for battlefield automated systems. The design of this Objective PDSS System provides an appropriate degree of uniformity and commonality throughout the system while recognizing the need for certain differences among system components because of variations in both current capability and current and future requirements for PDSS at the various centers and schools. The full implementation and effective management of this Objective PDSS System would provide HQ TRADOC and subordinate commands an adequate capability to fulfill their roles and responsibilities in planning and providing PDSS for BAS currently projected for deployment through 1987.

(b) Principal factors influencing system design. The principal factors influencing system design were:

1. Assumptions. The assumptions considered are those stated in Paragraph 3.d.

2. Design guidelines.

a. Relationship of PDSS to TRADOC mission and functions. Within TRADOC, PDSS is to be performed as an integral part of the system development and life cycle management process under the combat developments mission.

b. Relationship of PDSS to operational concepts. The system to be established for performing PDSS is to be in consonance with:

- TRADOC's operational and management concept of centralized management and decentralized control and operations, as described in AR 10-41 and TRADOC Regs. 10-5 and 10-41
- The Battlefield Functional Area (BFA) Concept discussed in Paragraph 3.a
- The Command, Control, and Subordinate Systems (CCS^2) concept currently promulgated within TRADOC
- The PDSS Concept Plan for BAS, May 1980.

c. Relationships among centers and schools. Relationships among PDSS organizational elements at the various centers and schools will be governed by the existing integrating center-associated center and school concept discussed in TRADOC Reg. 10-41. PDSS elements of key centers and schools should be interconnected by appropriate means to facilitate the coordination and interaction that must occur among these centers and schools in managing the major command and control BAS under the CCS^2 concept.

d. Organizational structuring. Within the common design guidelines set forth in this chapter, the PDSS system elements at each center and school may be individually tailored to best accomplish local PDSS requirements. The system should capitalize on existing analytical and software capabilities to the extent possible. The extent to which a center and school's PDSS capability is integrated into the existing organizational structure as opposed to being a separately identified organizational element may vary based upon:

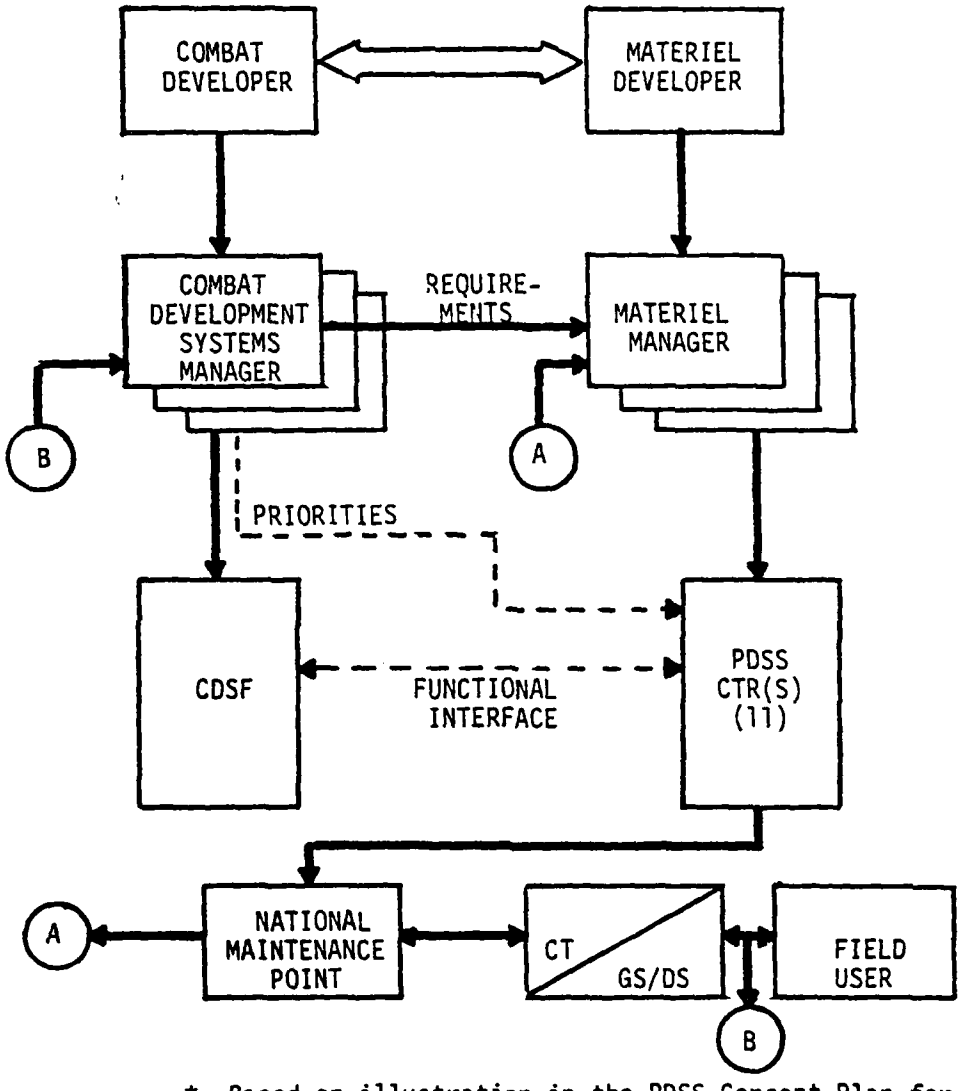
- Current capabilities to fulfill PDSS responsibilities
- The number, nature, and life cycle stage of BAS for which the center and school is responsible
- Relationship to an associated MD-managed PDSS center
- Desires and objectives of each center and school commander.

e. System implementation. This PDSS system represents an objective to be achieved by 1987 through the accomplishment of implementation actions integrated with the Army's Planning, Programming, and Budgeting System (PPBS) cycle. Resource requirements are identified as needed beginning in 1981.

(c) System Models

1. Generalized Software Support Model for PDSS. The Task Force that prepared the PDSS Concept Plan for BAS developed a generalized software support model for PDSS. This model, which illustrates the general roles of both the CD and MD in the PDSS process and their relationships with system Users, is illustrated in this report as Figure 14. This model combines aspects of organizational structure, physical location, and information flow. The model was designed to provide for a systematic flow of post-deployment software problems and solutions between the User and appropriate CD and MD organizations. As indicated, the focal point for MD PDSS activity is the PDSS center. The PDSS Concept Plan for BAS provides for establishing 11 of these centers as discussed in Paragraph 3.a. As shown in Figure 14, the CD counterpart to, and principal point of interface with, the MD-managed PDSS center is to be the CDSF. The CDSF, which represents the focal point for CD PDSS activity, is to operate in response to requirements of the CDSM who has CD PDSS responsibility for the system or systems being addressed. The CDSM, in turn, represents the CD in interactions with the Materiel Manager under whose supervision the PDSS center functions. It should be noted that the CDSF should be construed more as a physical facility than an organizational entity. Like a command post, the CDSF is essentially a place where equipment and personnel from various organizational entities are collocated and structured to most effectively perform certain PDSS functions, when or as required. The CDSF, with respect to both the physical facility itself and the staff entities located within it, may be either permanent or temporary.

GENERALIZED SOFTWARE SUPPORT MODEL FOR PDSS*



* Based on illustration in the PDSS Concept Plan for BAS, May 1980.

Figure 14. Generalized Software Support Model for PDSS

2. Generalized Combat Developer PDSS Models. Considering the structure and procedural concept of the Generalized Support Model for PDSS, and the Objective PDSS System design guidelines discussed above, the Study Team developed two models for the functional and management structure of the CDSF. Two generalized models (representing opposite points on a spectrum) were needed to accommodate the differences in current organizational structure, capabilities, and requirements among TRADOC centers and schools. The overall TRADOC Objective PDSS System design is based on one or the other or some intermediate variation of these generalized models being implemented at each center and school that has a need for a PDSS capability. The two models are described below:

a. CD PDSS Generalized Model 1. This model, which is illustrated in Figure 15, is based on the existence/establishment of a permanent organizational entity dedicated to PDSS functions and staffed by an element of the Directorate of Combat Developments or the Management Information Systems Directorate at centers and schools where this latter organizational element has PDSS responsibility. This PDSS entity is taken, in this model, to be located, together with personnel and equipment, in a permanent facility identified as a CDSF. This CDSF corresponds with the CDSF box shown in Figure 14. Other directorates and staff organizations of the center and school would support PDSS functions within their respective functional areas of responsibility, on an "as required" basis. The figure shows those elements constituting the permanent staffing of the CDSF as well as the principal organizational elements participating in PDSS functions "as required". The permanent CDSF staff element(s) function under the staff supervision of the Director of Combat Developments or a designated division or separate office chief of this directorate. Close staff coordination is maintained with the appropriate CDSM and with the TSM, if a TSM exists, and with other staff elements supporting PDSS functions. Both the CDSM and the Chief of the permanent CDSF Staff Element interface with MD counterparts as illustrated in Figure 15. The CDSM is the principal CD representative on PDSS matters involving the BAS(s) for which he is responsible. As indicated in Figure 15, CD organizations in any given CDSF may have to interface with more than one MD PDSS center since MD responsibility for the BAS(s) supported within a single CDSF may be assigned to more than one PDSS center, in accordance with the PDSS Concept Plan for BAS, May 1980.

b. CD PDSS Generalized Model 2. This model, which is illustrated in Figure 16, differs from Model 1 in that, with the exception of a designated PDSS focal point, no distinct PDSS organizational entity exists on a permanent basis and there is no permanent CDSF. Model 2 is based on the concept of PDSS functions being performed by existing organizational elements (augmented as necessary consistent with the additional workload resulting from PDSS). This model allows for the establishment of a CDSF on an ad hoc basis as required, with staffing being drawn temporarily from the Directorate of Combat Developments and other existing organizational elements that have PDSS responsibilities. When such a CDSF is formed, primary responsibility for direction and control of the total operation rests with the principal Combat

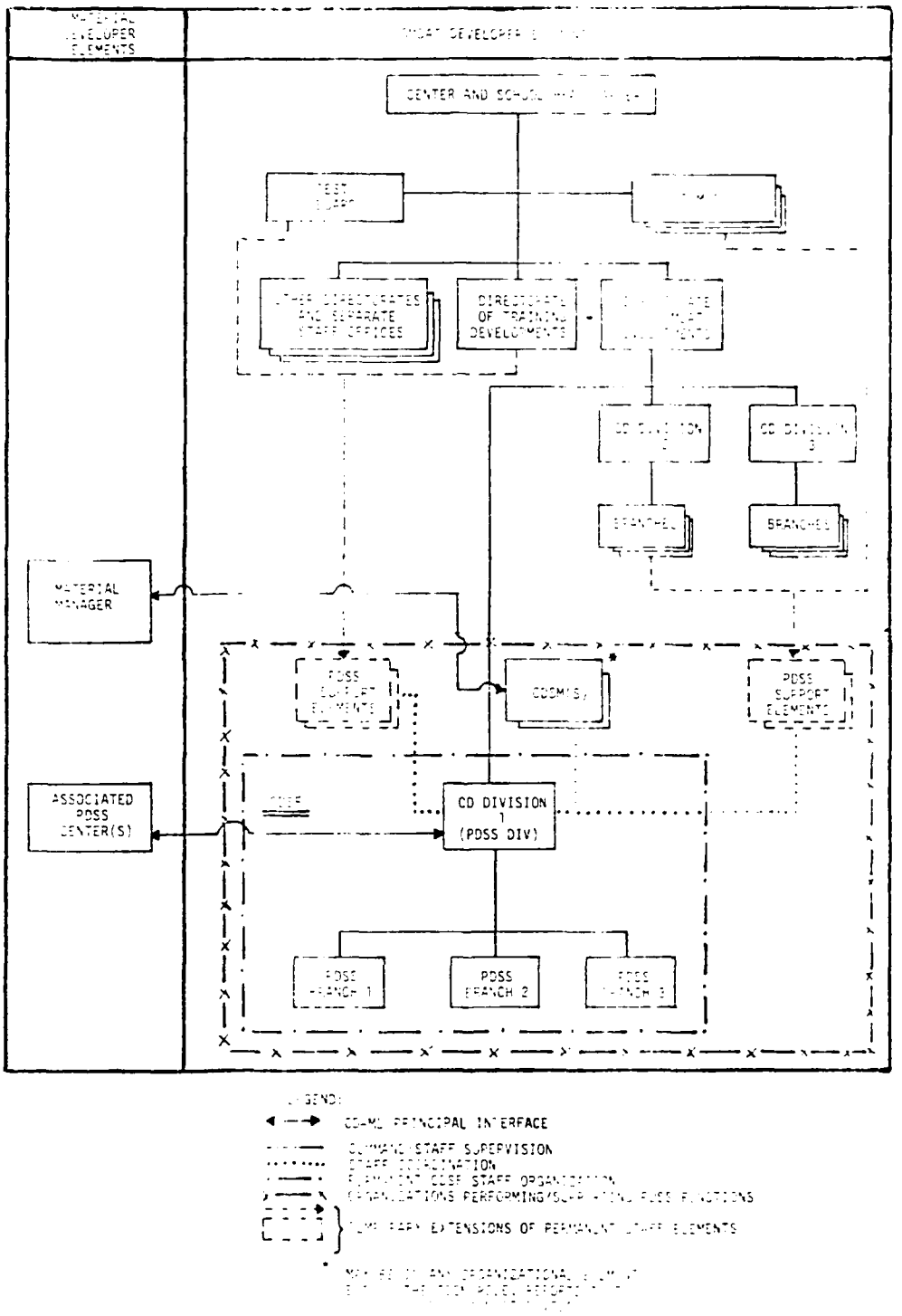


Figure 15. CD PDSS Generalized Model 1

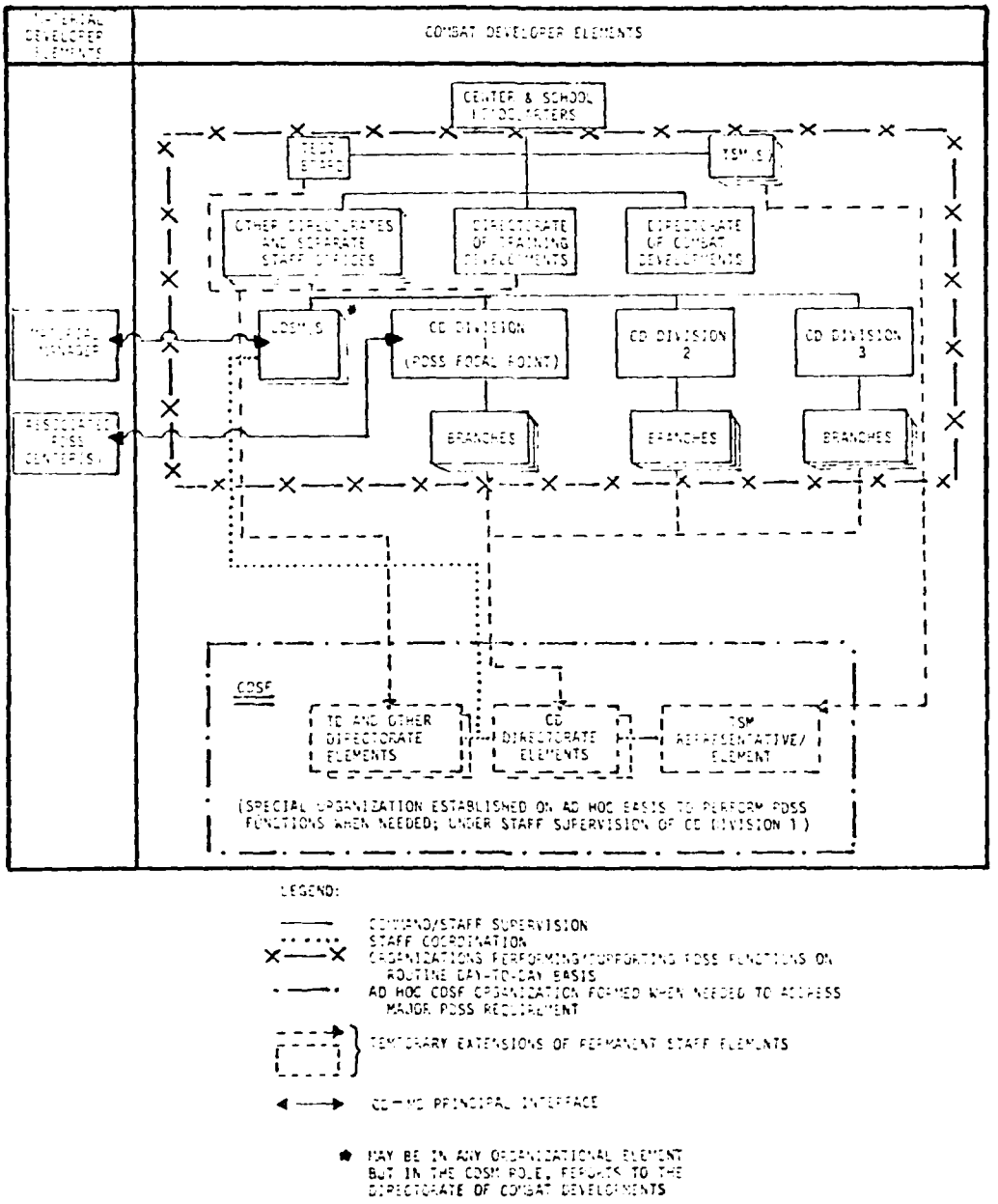


Figure 16. CD PDSS Generalized Model 2

Developments Directorate element involved. Other internal CD staff supervision and coordination, and CD-MD interface procedures and responsibilities envisioned under Model 2 are essentially the same as described for Model 1.

(d) Objective System Overview. Following the assumptions, design guidelines, generalized model alternatives, and other considerations discussed above, the Study Team designed and developed the description of the TRADOC Objective PDSS System. This system is illustrated in Figure 17, structured within the context of the BFA concept. This Objective System provides for:

- A PDSS Staff Element at Headquarters, TRADOC to provide a focal point for PDSS at the major command level and, in conjunction with the HQ TRADOC CD "hardware directorates," to coordinate and exercise staff supervision over PDSS matters within TRADOC
- PDSS Staff Elements at CACDA to provide a capability to fulfill assigned responsibilities as the TRADOC PDSS proponent and principal integrating center and as proponent of the CCS^2 concept
- A PDSS capability at the seven major TRADOC doctrinal centers that have proponency for functional area components of the BFA concept
- A CDSM for each BAS that has reached Milestone II in the system development cycle (or a comparable point for systems being developed under other (e.g., evolutionary) concepts) (A CDSM may be responsible for more than one BAS.)
- A capability to establish and maintain an interface with geographically separated MD PDSS centers with which the CD must interact regularly in planning and providing PDSS for BAS for which the MD and CD each have major responsibilities in their respective functional areas. The way in which interaction is accomplished, whether by permanent liaison, TDY, or other means, is the prerogative of each center and school, in coordination with its MD counterpart(s).

It is emphasized that the composition of this total system as well as each of its elements has been tailored to satisfy TRADOC's functional PDSS requirements. Each component and subordinate element of the system is discussed in detail in Paragraph 2-5, Volume IV, Third Interim Technical Report.

(e) Concept of operations. The concept of operations associated with this Objective PDSS System is in full accordance with current Department of the Army and TRADOC operating policies and procedures. Principal elements of this concept are discussed below.

1. HQ TRADOC. The Commanding General, TRADOC, through the Deputy Chief of Staff for Combat Developments (DCSCD), establishes operating policy, determines priorities, allocates and manages resources, and directs all elements of this Objective PDSS System in the accomplishment of

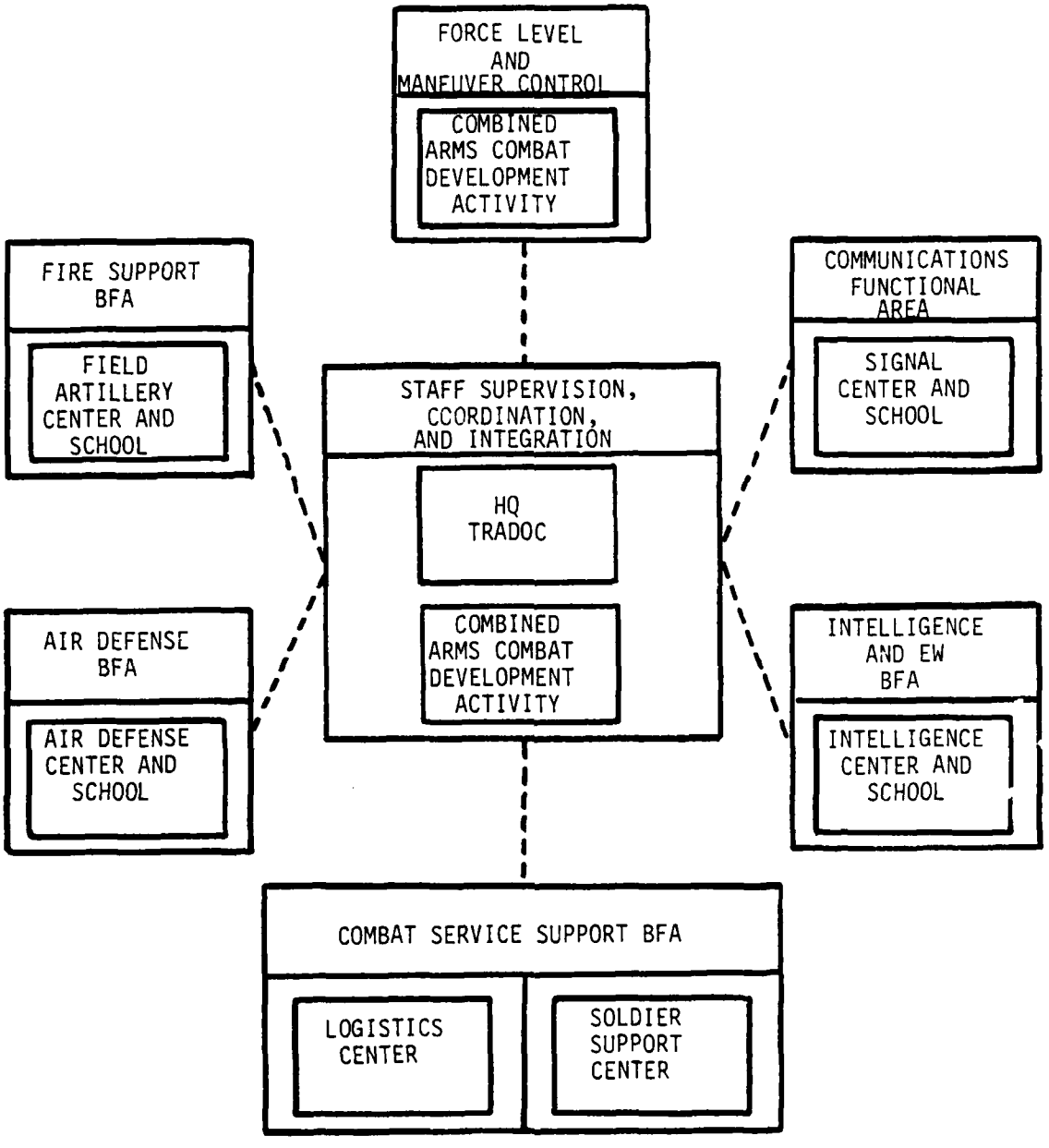


Figure 17. Overview of the Objective PDSS System

the overall mission and principal functional responsibilities. Within DCSCD, the Telecommunications, Command and Control, and Computer Systems (TC4S) Directorate, the Systems Management Directorate, and each of the "hardware directorates", e.g., Firepower Systems, Maneuver Systems, etc., have PDSS responsibilities.

a. DCSCD TC4S Directorate. The Director, TC4S, exercises staff supervision over the total operation of the system. Within this Directorate, the Battlefield Systems Integration Branch provides the focal point for coordinating TRADOC PDSS activity and requirements. This branch is responsible for receiving and acting or coordinating action on directives or requirements from Headquarters, Department of the Army (HQDA), or the Commanding General and other appropriate officials of Headquarters, TRADOC, and on requests from User commands. In conjunction with the DCSCD hardware directorate(s) and the CACDA PDSS Staff Element (discussed below), this branch analyzes and translates these requirements into instructions for issuance by Headquarters TRADOC to subordinate commands. Subsequently, the branch exercises staff supervision and acts in coordination with other staff elements of DCSCD on the products of subordinate elements of the system.

b. DCSCD hardware directorates. The DCSCD hardware directorates exercise staff supervision for total systems management of systems within their respective functional areas.

c. DCSCD Systems Management Directorate. The Systems Management Directorate exercises primary staff responsibility for management of the TRADOC Materiel Total System Management Concept and the TSM Program.

2. CACDA. CACDA is responsible in this Objective System as the TRADOC PDSS Proponent. Responsibilities associated with this role include working, in conjunction with the PDSS staff at Headquarters TRADOC, to address major PDSS functional and management matters, and coordinating and integrating, as appropriate, PDSS requirements and activity of the TRADOC centers and schools.

3. BFA-level operations. As noted in the System Overview, this Objective System provides for a PDSS capability within each of the seven functional areas recognized in the BFA concept. This PDSS capability is established and will operate as an integral part of the combat developments or management information systems organization of each parent center and school. This PDSS capability provides a focal point for all substantive PDSS activity within each of the seven functional areas of the BFA concept and provides the primary interface on PDSS matters at the BFA level with organizations external to TRADOC. Each of the centers and schools that is to have a PDSS capability will be responsible for planning, directing, coordinating, and performing all CD PDSS functions for the BAS within their respective functional areas. This includes maintaining contact with Systems Users on functional/operational matters and with MD PDSS centers on all aspects of PDSS for the BAS with which they are concerned. The CD PDSS LNOs included in this Objective System are extensions of their respective CDSF. They facilitate

CD-MD interaction on PDSS for the BAS with which they are concerned and provide the principal User-representation at the MD PDSS center where they are located. Those centers and schools choosing not to establish permanent liaison representation at geographically separated MD PDSS centers with which they must interact, must accomplish this functional requirement by other means consistent with the concpet and objectives of this TRADOC Objective PDSS System. A detailed description of each of the seven BFA-level Objective PDSS System components is given in Paragraph 2-5, Volume IV.

4. Principal interfaces. To properly fulfill its CD PDSS functions, HQ TRADOC and each center and school involved with the Objective PDSS System, must interact with both Users and Materiel/System Developers on a continuing basis. The CD liaison elements or points of contact to be established as part of this Objective PDSS System will facilitate this interface. A summary of the principal CD-MD-User interfaces that are seen to be required following implementation of the PDSS Concept Plan for BAS, are shown in Figure 18.

(f) Resource requirements. The detailed description of the Objective PDSS System contained in Volume IV, Third Interim Technical Report, includes a discussion of estimates of resource requirements necessary to implement the system. While the estimates of resource requirements included in that discussion must be developed further and refined during detailed implementation planning at the center and school level, a summary of the total personnel estimated to be needed is provided in Figure 19. The data shown are subject to change during the detailed planning referred to above, but are presented here to provide an indication of the magnitude of the resources needed for this critical functional area.

(g) Implementation planning.

1. Structure of the plan. A proposed implementation plan, to be staffed, approved, and issued by HQ TRADOC, has been prepared and is included as Appendix D of Volume IV, Third Interim Technical Report. The proposed implementation plan covers those principal actions or events that need to be accomplished during the initial period of this TRADOC implementation effort, from March 1981 through March 1982. If this schedule is maintained, other actions originating from these initial actions will then continue on for several years before full implementation is achieved in 1987. During this period and beyond, a number of actions associated with the TRADOC Resources Management System (TRADOC Pam. 11-11) and the Priorities and Tasking Control Process (TRADOC Reg. 11-2) must be accomplished on a recurring basis.

2. Critical aspects of the schedule. In the interest of proceeding with implementation expeditiously, a very compressed schedule has been proposed for the execution of this plan. For example, it provides for the accomplishment of special actions directed toward the inclusion of critical PDSS resource requirements in the FY 83 TRADOC Command Budget Estimate (CBE). If these actions are not taken, a delay of one year may be experienced in getting PDSS requirements into the programming and budgeting process. To

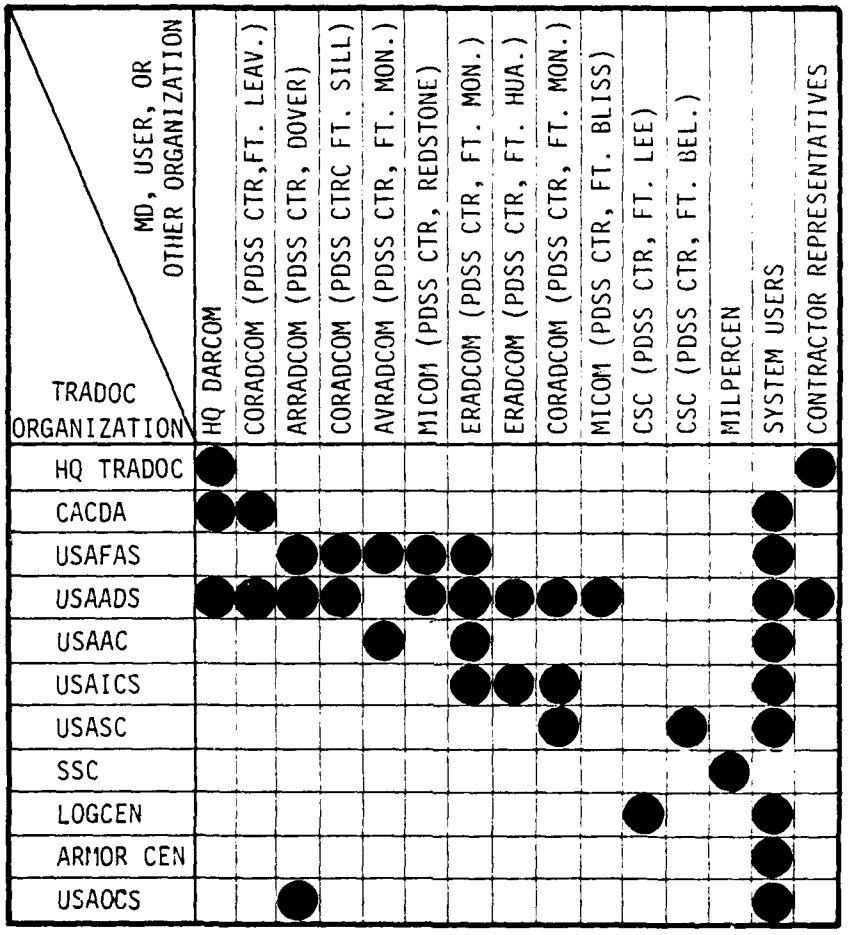


Figure 18. Principal CD-MD-User PDSS interfaces

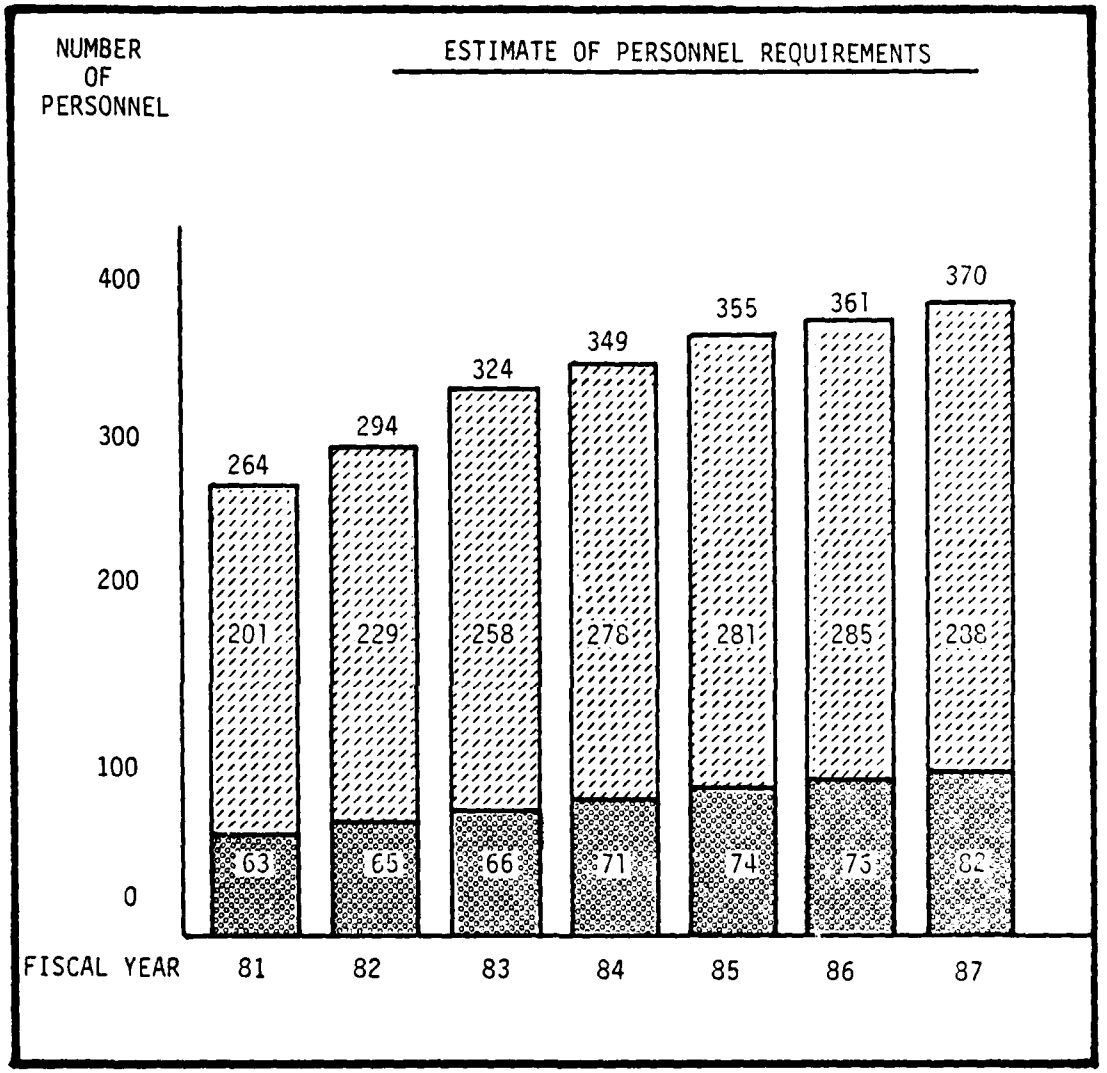


Figure 19. Estimated TRADOC PDSS personnel requirements by fiscal year

meet the schedule that is proposed, some actions must be initiated immediately following receipt of this final report. Some of these early actions would have to precede the finalization and issuance of the proposed implementation plan since the proposed schedule provides for the plan to be revised following formal TRADOC review (expected to be in late March or early April) and staffed, published, and distributed in late August or early September 1981.

4. CONCLUSIONS. The following conclusions are reached based on results of the research and analysis conducted throughout Phases I, II, and III of this study.

a. The importance of establishing a systematic approach to planning for and providing PDSS to BAS on an Army-wide basis is increasing rapidly as growing numbers of sophisticated systems continue to be fielded.

b. To date only a few BAS have involved TRADOC in serious participation in PDSS activities. In the next six years, however, approximately 26 BAS requiring significant TRADOC participation in PDSS will emerge.

c. Historically, PDSS has not been addressed explicitly in Army regulatory documents. Partly as a result, PDSS has not been clearly identified as a continuing responsibility within the Combat Developer's role in the system development and life cycle management process.

d. Analysis reveals that TRADOC does have significant PDSS responsibilities that need to be fulfilled. Effectiveness and readiness of Army forces will increasingly depend on fulfilling those responsibilities. They are itemized in Figure 11, above.

e. TRADOC is not currently fulfilling all responsibilities inherent in its PDSS role, and cannot fulfill these responsibilities with resources presently committed to this functional area.

f. An improved PDSS capability is needed at HQ TRADOC and at the major centers and schools that have combat development proponency for one or more BAS.

g. The proposed TRADOC Objective PDSS System, which was defined through this study effort, presents the preferred means of adequately fulfilling TRADOC PDSS responsibilities into the late 1980's.

h. The Objective PDSS System reflects views regarding PDSS held by the principal TRADOC centers and schools and provides a separately tailored blueprint which each such center or school can follow in PDSS implementation. (For details, see Volume IV, Third Interim Technical Report.)

i. The PDSS Implementation Plan developed in the study charts principal events necessary to transition from the current to the Objective PDSS System, within TRADOC. This Plan covers events in the next 12 months. Implementation is seen to be completely achieved in 1987. (For details, see Appendix D to Volume IV.)

j. Substantial additional resources are needed to satisfactorily fulfill TRADOC PDSS requirements. These requirements, in terms of numbers of people, alone, are summarized in Figure 19, above, for the Objective TRADOC PDSS System.

k. The PDSS resource requirements of the individual TRADOC centers and schools vary widely. A detailed discussion of each BFA, for which these resource requirements were estimated, is presented in Volume IV, Chapter 2, and provides rationale for the estimates and differences.

l. Policy governing TRADOC's responsibilities for and participation in planning and providing PDSS for BAS should be formalized in a TRADOC regulation.

5. OTHER OBSERVATIONS.

a. Division in ADP Regulatory authority remains a problem. Regulatory policy governing the acquisition and life cycle management of automatic data processing systems in the Army is divided between two sets of regulations--the AR 18-series, on the one hand, and AR 1000-1 and the AR 70-series, on the other. Problems stemming from this division remain despite recent actions taken toward clarifying matters. (For additional detail see pp. 18-19 above, and First Interim Technical Report, p. 4-1.)

b. Army Regulations treat post-deployment period too lightly. The post-deployment period of the system life cycle in general, and post-deployment software support in particular, have not been addressed sufficiently in the basic Army regulations governing system acquisition and life cycle management (i.e., AR 1000-1, AR 70-1, and AR 18-1). (For additional detail see p. 19, above, and First Interim Report, p. 4-1.)

c. Heavily automated BAS have complex impact on training resource requirements. In large, heavily automated BAS, training software is often incorporated in the BAS itself to facilitate operator proficiency. Separate, institutional training devices also tend to be required for early training of operators and maintainers. Automated training scenarios are often required. BAS changes impact throughout this chain, creating significant resource requirements under the training side of TRADOC's responsibilities. (For additional details see First Interim Report, p. 4-2.)

d. Need for simulation and analysis capabilities highlighted by BAS experience. Development of system and system software requirements is a major TRADOC responsibility and requires detailed insight into the potential behavior of system variables, their tradeoffs, and payoffs. These needs are underscored by problems that have been experienced with some BAS. (For additional details, see First Interim Report, p. 4-2 and 4-3.)

e. Need remains for better way of stating requirements. One of the Combat Developer's principal functions in the PDSS process is defining system and software requirements in clear meaningful terms to the Materiel Developer. Phase I research indicates that in many cases, this poses serious difficulties for the Combat Developer even when functional requirements are well known. (For additional detail, see First Interim Report, p. 4-3.)

f. Evolutionary development implications need study. The evolutionary development procedure authorized under Paragraph 13 of DODI 5000.2 carries a number of implications that need to be considered with respect to configuration control, post-deployment support, training requirements, and other related areas.

g. Hierarchy of configuration control boards needed for CCS^2. The CCS^2 (formerly ECS^2) concept for battlefield automation and the requirement for interoperability among BAS within this concept appear to make the establishment of a hierarchy of configuration control boards desirable. (For further details, see First Interim Report, p. 4-4.)

h. Satisfaction of PDSS skill requirements may call for special steps. The types of skills needed for BAS PDSS, the quantity of people required, and the anticipated shortage of critical skills suggest that attention needs to be given to ways of solving a potentially difficult problem. (For additional detail, see First Interim Report, p. 4-5.)

i. Grade level ceilings at TRADOC centers & schools may need revision. Difficulty has been experienced at some TRADOC schools/centers in obtaining, retaining, and motivating skilled civilians, particularly in the GS 12 range. At these locations, existing grade ceilings allow little or no room for promotion above GS 12. Unless corrective action is taken, this difficulty may seriously impede implementation of needed PDSS plans. Having spaces authorized, alone, does not solve the manpower problem.

j. Testing needs of PDSS do not fit some interpretations of DODD 5000.3. Paragraph D.6.c. of DOD Directive 5000.3, Test and Evaluation, states that, "Before release for operational use, software developments for either new or existing systems shall undergo sufficient operational testing as part of the total system to provide a valid estimate of system effectiveness and suitability in the operational environment." This statement has apparently been interpreted by some personnel at the US Army Operational Test and Evaluation Agency (OTEA) and at HQ TRADOC to mean that Operational Test II must be conducted following every modification to system software. This interpretation has resulted in the conduct of some tests that go beyond those considered to be required by other members of the Combat Developments Community. This subject area needs to be addressed jointly by TRADOC, DARCOM, and OTEA to ensure that unnecessary testing is not conducted (thus causing unacceptable delays) and that there is common agreement regarding responsibilities for testing software modifications.

k. Responsibility for determination of training device requirements not clearly placed. TRADOC Reg. 10-41 does not clearly place responsibility for determination of training device requirements in either the Training Developments or Combat Developments arenas (TRADOC Reg. 10-41, page 4). This ambiguity appears to be reflected at some TRADOC schools, with a resulting danger that unnecessary delays may occur in proper recognition and definition

of such requirements. Because of the impact that BAS may have on resource requirements (Paragraph c., above), such delays could be serious in terms of costs and combat readiness. Clarification of this responsibility appears desirable, and may also improve cooperation.

l. TRADOC Reg. 71-12 needs to be reviewed. TRADOC Reg. 71-12 establishes policies governing the Total System Management process within TRADOC and implements the TRADOC System Manager (TSM) concept. There have been instances when local interpretation of this regulation has resulted in conflicts with respect to responsibilities of the TSM as opposed to those of the Directorate of Combat Developments. This observation indicates a need to examine the provisions of TRADOC Reg. 71-12 with a view toward determining if any revision is needed to clarify responsibilities in this functional area.

m. Standardized software-problem report forms are needed. The PDSS Concept Plan for BAS identifies the review of these forms for possible standardization as an area requiring action during implementation of the plan. This requirement is repeated here to emphasize the importance attached to it by elements of the Combat Developments Community.

n. TRADOC centers & schools need to prepare detailed PDSS implementation plans. Individual TRADOC centers and schools need to prepare detailed plans for PDSS implementation at their respective locations, based on the general plan formulated in this study effort.

o. Computer resource implications need to be examined TRADOC-wide. A number of questions have arisen during this study effort concerning computer resources for PDSS and other purposes in TRADOC. Among these questions are issues of computer needs/workloads, types, locations, costs, resource sharing, procurement, and trends involved. A TRADOC-wide examination of these issues and their implications appears needed.

p. Audit trail data for predicting optimum allocation of resources is lacking. This study found little data on PDSS experiences within TRADOC that was useful for quantitatively predicting the optimum allocation of combat developer resource requirements over the system life cycle. An effort should be made to collect data reflecting experiences and lessons learned on a system by system basis to support future resource requests and allocations and other planning, programming, and budgeting actions.

q. Multiplicity of BAS hardware types and software languages remain complicating factors. The current multiplicity of BAS hardware and software languages will remain complicating factors in training, logistics, and PDSS well after the introduction of the Ada language and the military computer family (MCF).

r. Early analysis can reduce PDSS and other system problems. Early analysis of software sensitivity and flexibility to changes in the threat, doctrine, and tactics, if appropriately reflected in system software design, can reduce later PDSS and other system problems.

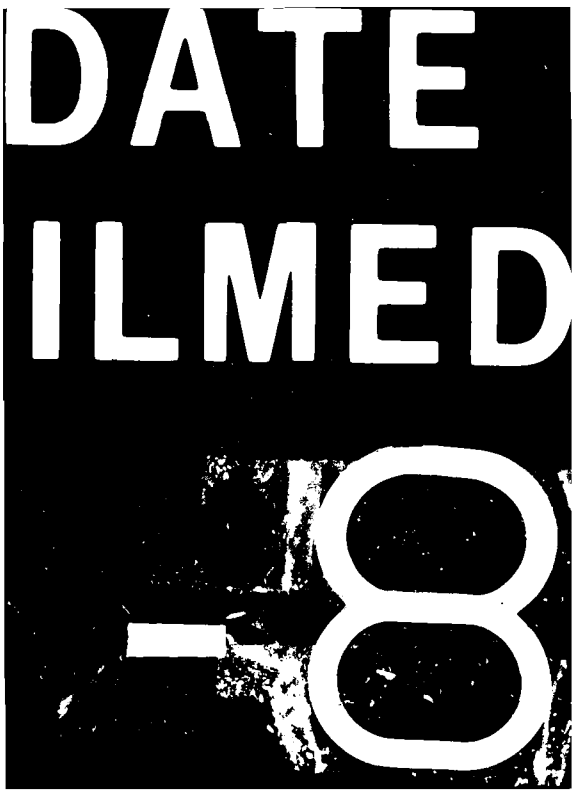
s. Crisis/wartime PDSS requirements may require special measures. The PDSS Concept Plan for BAS addressed the flow of PDSS problems and solutions through the generalized software support model for PDSS, to include crisis/wartime support response. The importance and criticality of crisis/wartime support and the nature of certain situations or requirements, may necessitate that special measures be adopted for providing PDSS and that procedures to be employed be tailored to the immediate circumstances. Such requirements must be addressed jointly by the MD, CD, and User on a system-by-system basis to ensure that proposed solutions are feasible and tailored to best satisfy the User needs.

6. RECOMMENDATIONS. Whereas the Commanders of DARCOM and TRADOC have approved the PDSS Concept Plan for BAS, as initial steps in implementing that plan within TRADOC, it is recommended that TRADOC:

a. Adopt the proposed Objective PDSS System.

b. Approve the implementation plan as set forth.

c. Publish the implementing regulation and modify such other regulations as necessary.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